JUNE 1961

Heating Piping & Air Conditioning

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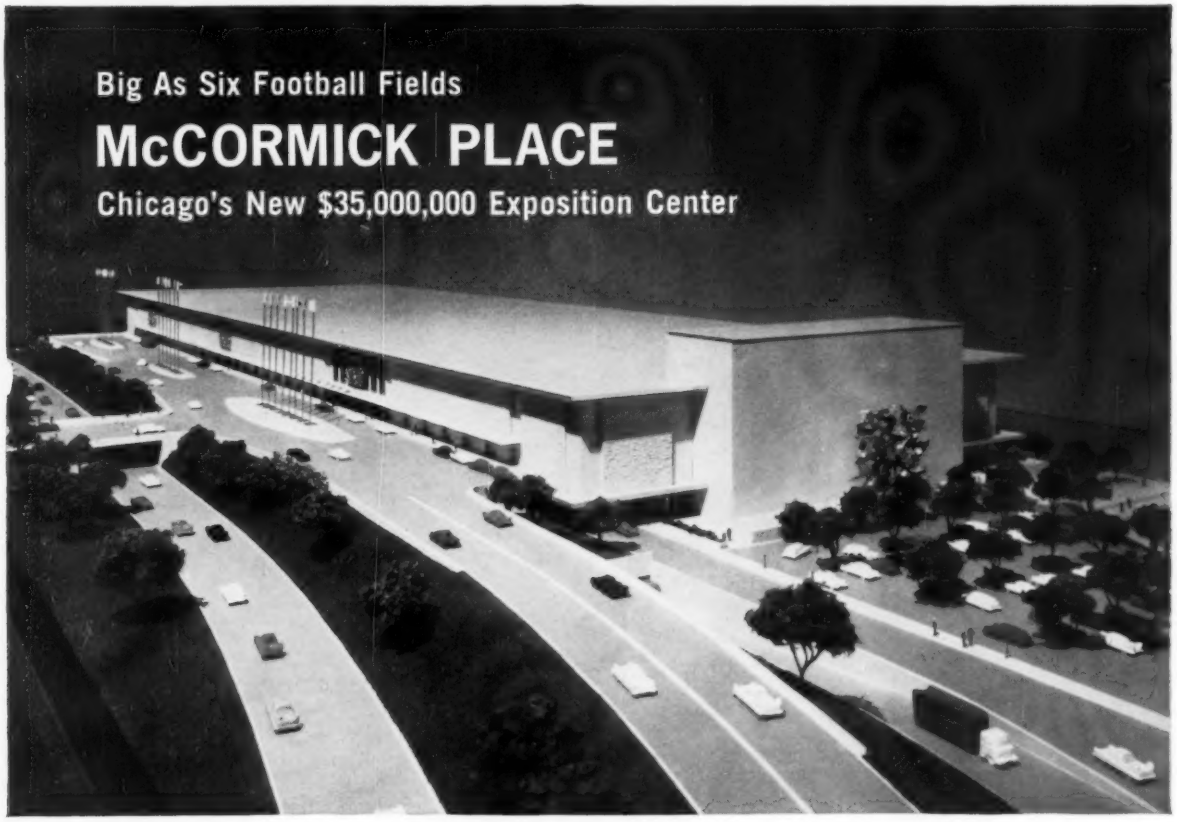

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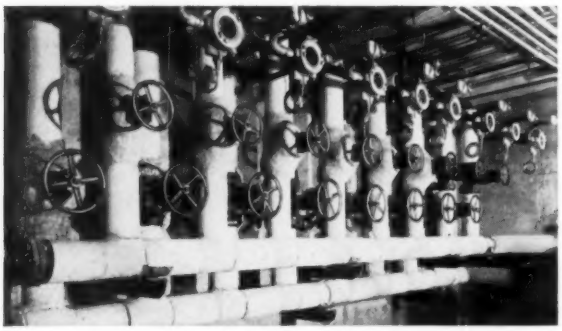

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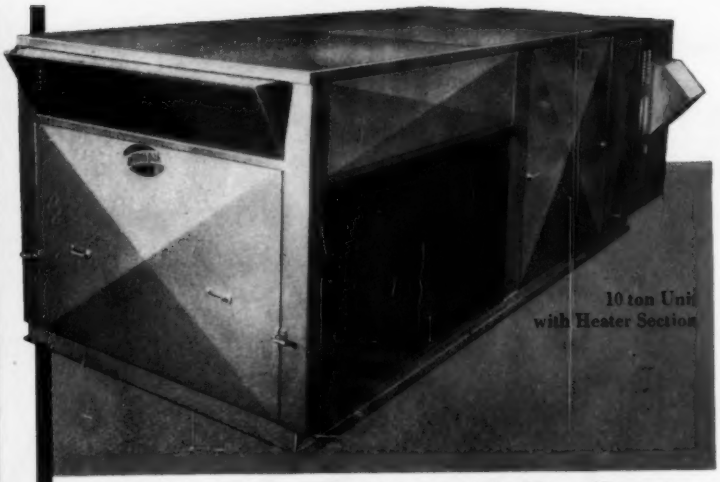

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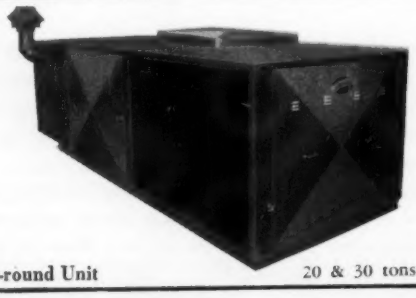

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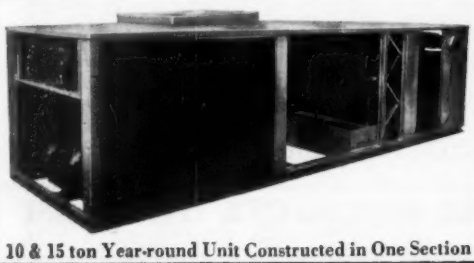

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VOL. 33, NO. 6 JUNE 1961

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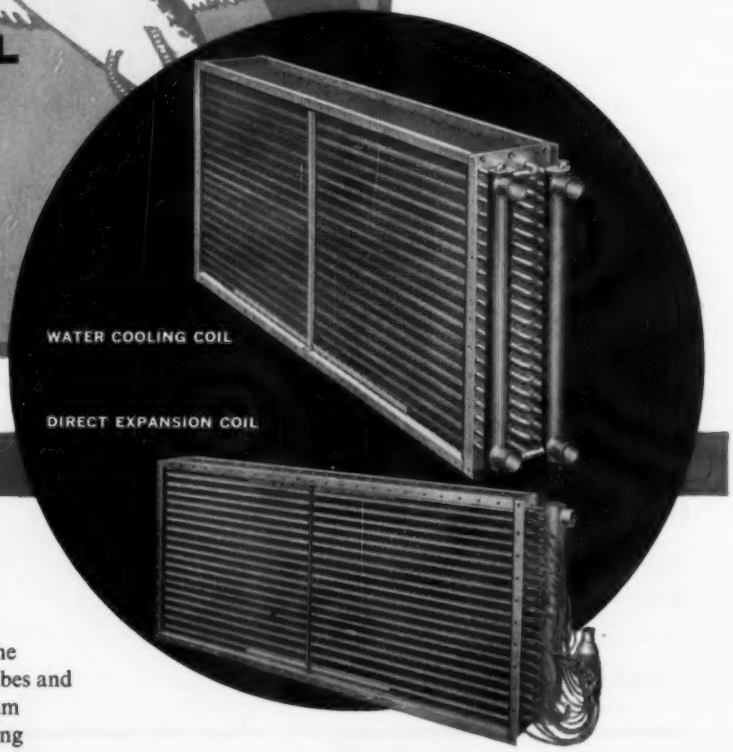

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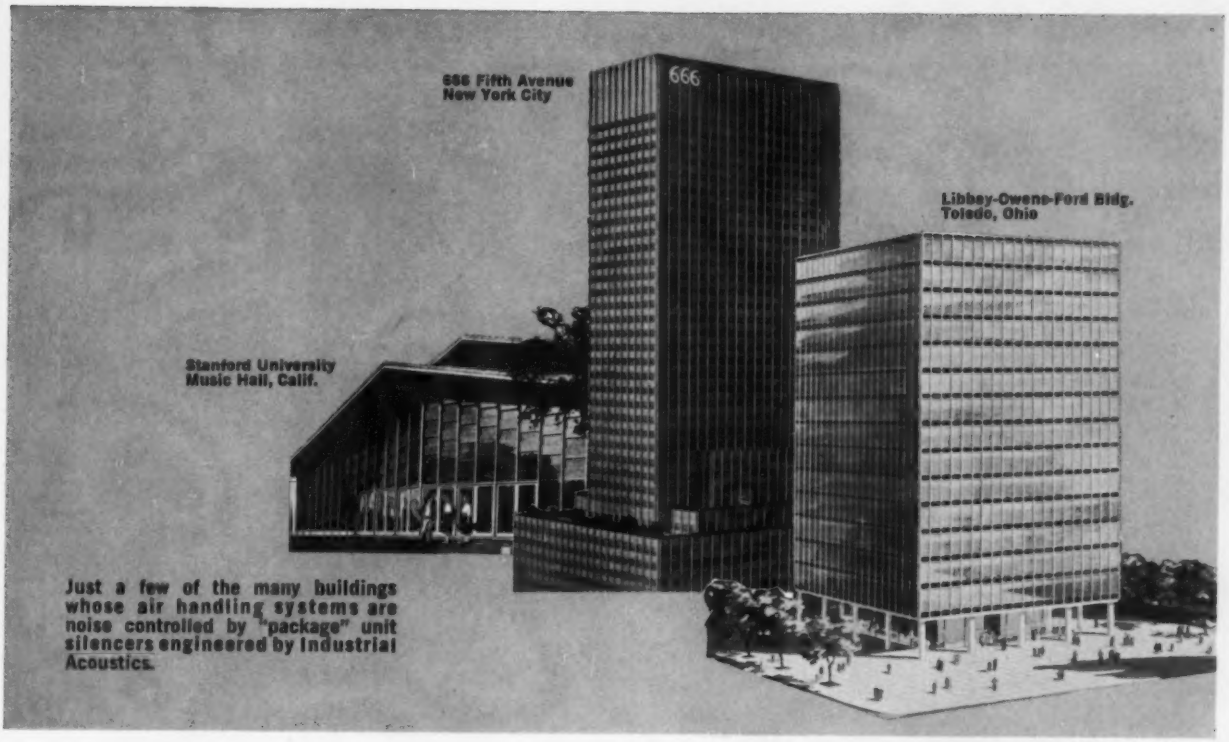

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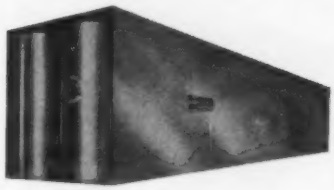

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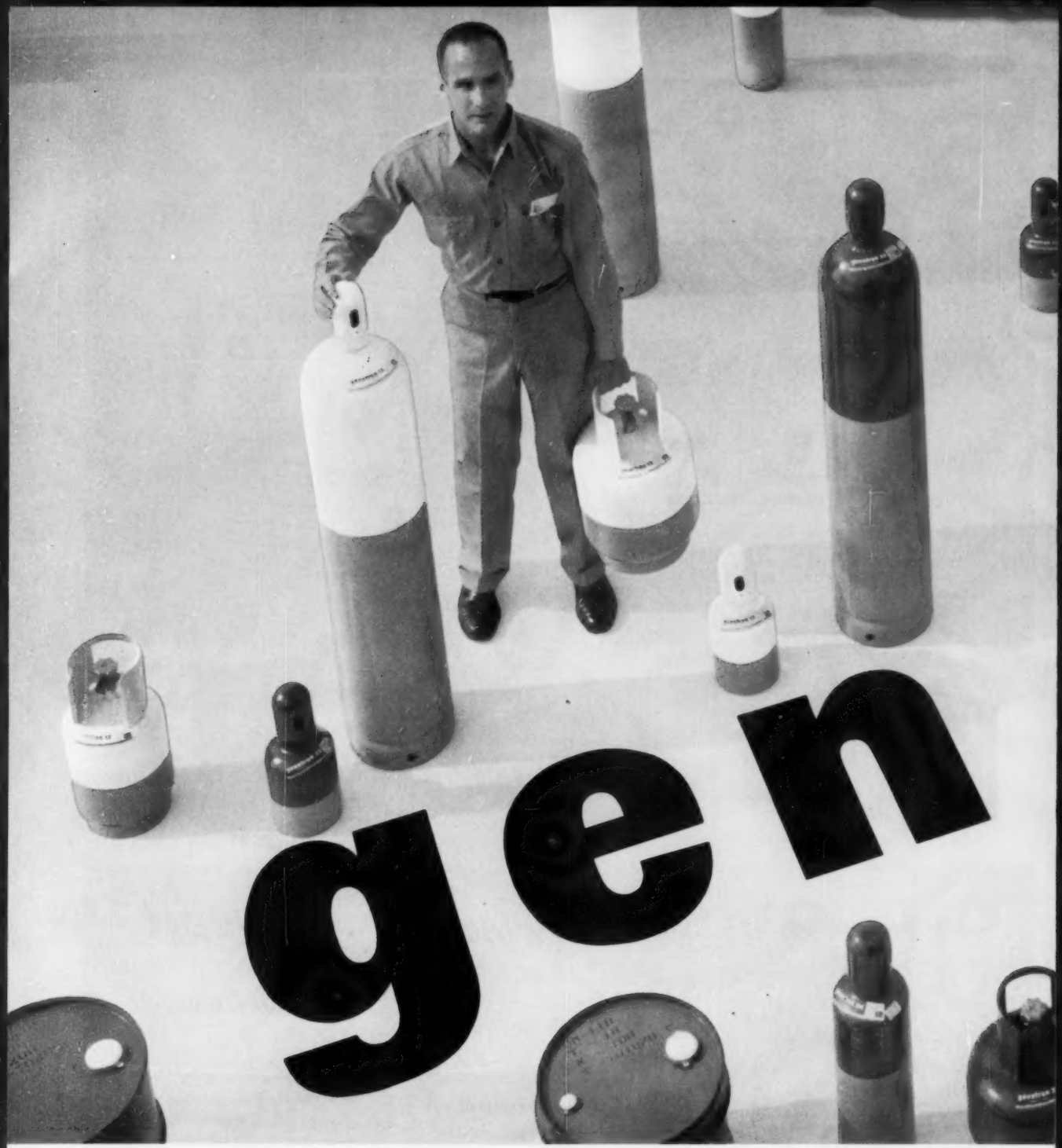

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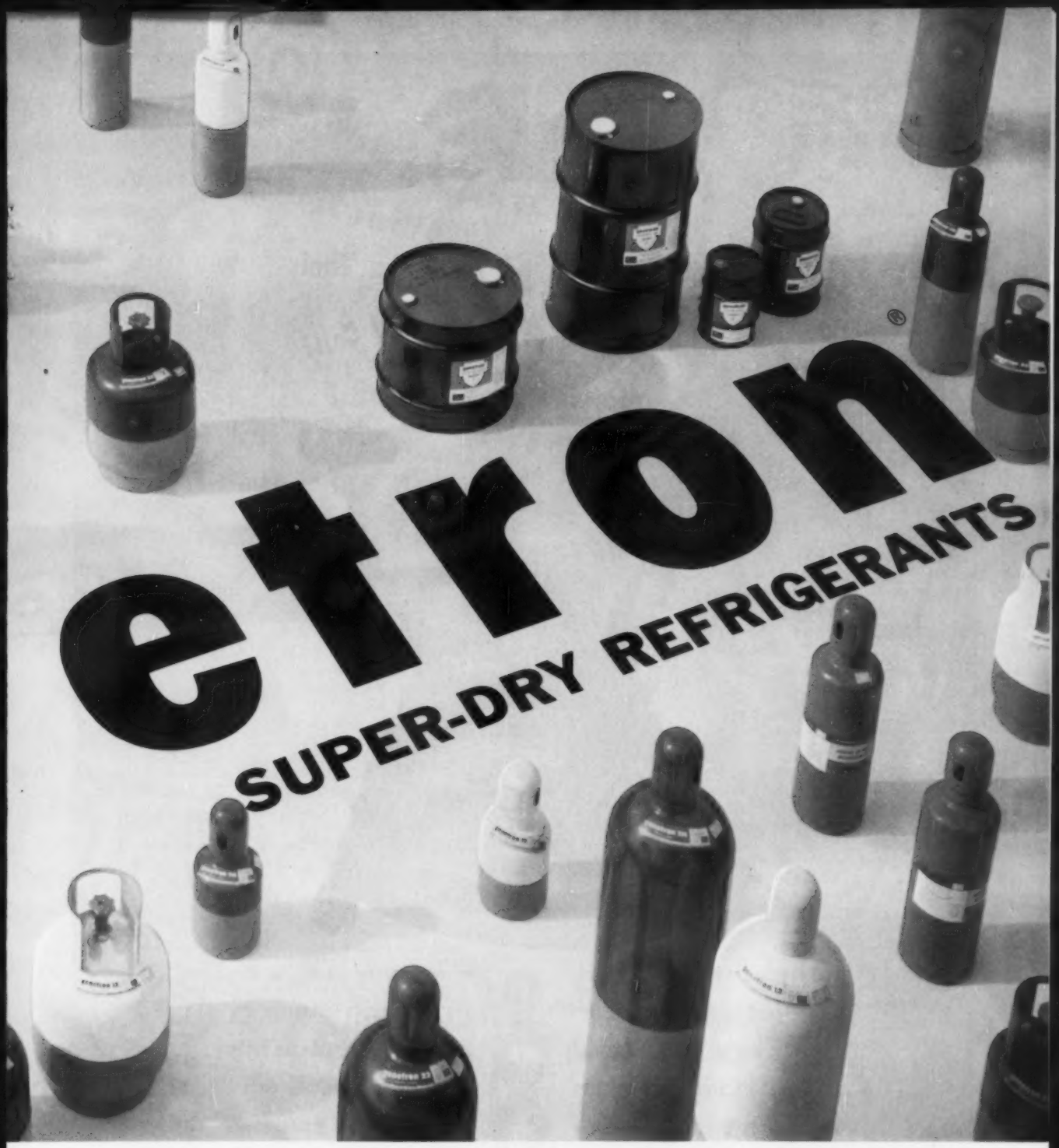

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LETTER FROM THE EDITOR

June 1961

Dear Reader:

Designing the pneumatic conveying system for collecting aluminum scrap at the Mirro Aluminum Company's new plant was a real challenge to the consulting engineers who designed the system. Many factors had to be considered in the design since the scrap varies with the period of operation, the character of the scrap is not constant, and the rate of scrap accumulation is also a variable. The design of this system, as explained in the article on page 101, shows how a minimum of working space was used as was a minimum of equipment to achieve the objectives of low installation and maintenance costs. Of course the labor saving feature is an important economy also.

Some new ideas for designing and installing air conditioning systems where the chief problem is one of compensating for unusually high internal heat loads is presented by F. J. Grande in his article on page 106. He illustrates his points by referring to a computer room installation where 20 data processing machines produce a machine heat load, which when added to the normal room load, equals some 288,000 Btu per hr. Often it is not practical to use an overhead air supply type of design, and sometimes esthetics rule out the use of too many hoods and exposed ducts for these installations. Mr. Grande explains how an all under-floor supply system for both comfort and machine cooling, plus an adjustable overhead return duct system has worked out so well in this application.

How the piping systems were designed and installed for the new supercritical pressure power plant for the Indiana & Michigan Electric Company's new plant is explained by G. E. Lien and A. J. Breugelmans on pages 110 to 115. Designing these piping systems for pressures ranging from 4600 psi to a vacuum and for temperatures from 1050 F to 32 F was both interesting and challenging. Of course the economics of pipe size, stresses, pipe materials, and erection methods were studied, reviewed, and studied over again to be sure the final design was right. Many testing experiences are included in this article that should be of real interest to engineers and contractors alike.

The question of what temperature-pressure conditions will result when leaks occur in high temperature hot water heating systems is one that has been given much thought and discussion because of the safety of the tenants in the heated space. Wilfred H. Comtois has developed a very careful analysis and a procedure for calculating these space temperature-pressure conditions which will result when a leak occurs. This is presented in his article on page 116. Mr. Comtois has applied the principles developed for protecting the public outside the containment shells of pressurized water nuclear reactors and has extended these to embrace the problem of protecting people who are inside a space heated with high temperature hot water.

To heat the world's largest Oldsmobile dealer's showroom and service facilities, it was decided to use a combination of a warm air perimeter system and gas-fired infrared radiant heaters. The perimeter system is used in the showroom because of the full-height glass walls. Warm air is delivered upward in the winter to compensate for the cool air dropping off the windows, and cool air is circulated through this system during the summer. Infrared heating is used in the service building. The owners demanded that a draft-free environment with warm floors be provided with immediate control. To accomplish this, gas-fired infrared units were selected and installed at strategic points. One thermostat is used to control each six units and for each group of six units a power roof ventilator is installed to exhaust the products of combustion. This article is on page 121.

LETTER FROM THE EDITOR (continued) --

To provide a close-to-natural environment for orchids, coffee and tea plants, jungle fruits and flowers, a unique heating, ventilating, and evaporative cooling system was designed by Paul Londe and Associates to serve the new Climatron in St. Louis. Both tropical and semi-tropical climates with different temperatures and humidities in particular areas are necessary and the article on pages 124 to 127 shows and explains how these requirements are met. The air supply for the two systems overlaps, and the planned air flow paths for each system are quite unique. The control of these conditions within this large aluminum and plexiglass hemisphere is also a major part of this design, as you might expect.

We asked George F. Winterson, plant engineer at the Dewey & Almy Chemical plant in Owensboro, Kentucky to record his experiences with piping "hard to handle" substances. He has done this in his article on pages 128 to 130, and I am sure you will find this article to be of interest. He recommends specific types of piping materials and methods for fluids such as butadiene, latex, hot oil, and organic raw materials. Stainless steel, plastics, rubber, aluminum, and iron piping have all been used with success.

The legal tip this month on page 131 is on signatures. John Morrissey warns that signatures can make you liable under some circumstances instead of your company.

How to prolong life and improve performance of heating system electric motors is explained by Leo Kowal in his article on page 132. He reports the results of an extensive survey made in cooperation with several motor service shops throughout the eastern part of the United States. Repairs were tabulated which were needed on almost 700 heating system motors as they were taken down for service. Start switches, motor bearings, and winding burnouts were the most frequent causes of failures.

Water circuits in air conditioning systems are extremely susceptible to corrosive attack because of repeated aeration of water and because of the variety of metals employed in the equipment, according to Sidney Sussman and Irving L. Portnoy in their article on pages 134 to 140. They also point out that the secondary effects of acidic materials scrubbed from the air in cooling towers, evaporative condensers, and air washers also tend to increase corrosion rates. The authors explain the various ways in which corrosion occurs in these water systems, and they present some interesting experiences obtained in various parts of the country.

The methods used to hide the smokestack in the headquarters office building of the Prudential Insurance Company in Newark, New Jersey are of interest, and perhaps they can be applied in other problem cases of this type also. Insulation was a major factor as was the location for the stack which was in an unused corridor space. The article is on page 141.

How to use natural gas as the prime energy source for air conditioning is explained in detail in the article beginning on page 144. This report is based upon information presented at recent air conditioning schools sponsored by the American Gas Association. The subjects covered in this report are on absorption refrigeration, natural gas engines as prime movers, steam turbine drivers, and gas turbine drives. The article is a good reference piece for future use.

The nomograph on the Data Sheet on page 153 will be useful in aiding in the determination of the temperature-humidity index which we see as becoming more and more useful as an indication of comfort.

Don't miss the "Open for Discussion" pages containing the comments from readers on pages 87 to 92. Many news items and other short items of interest will be found in the "You'll Want to Know" pages on 49 to 52. The "Question of the Month" is on pages 94 and 96.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

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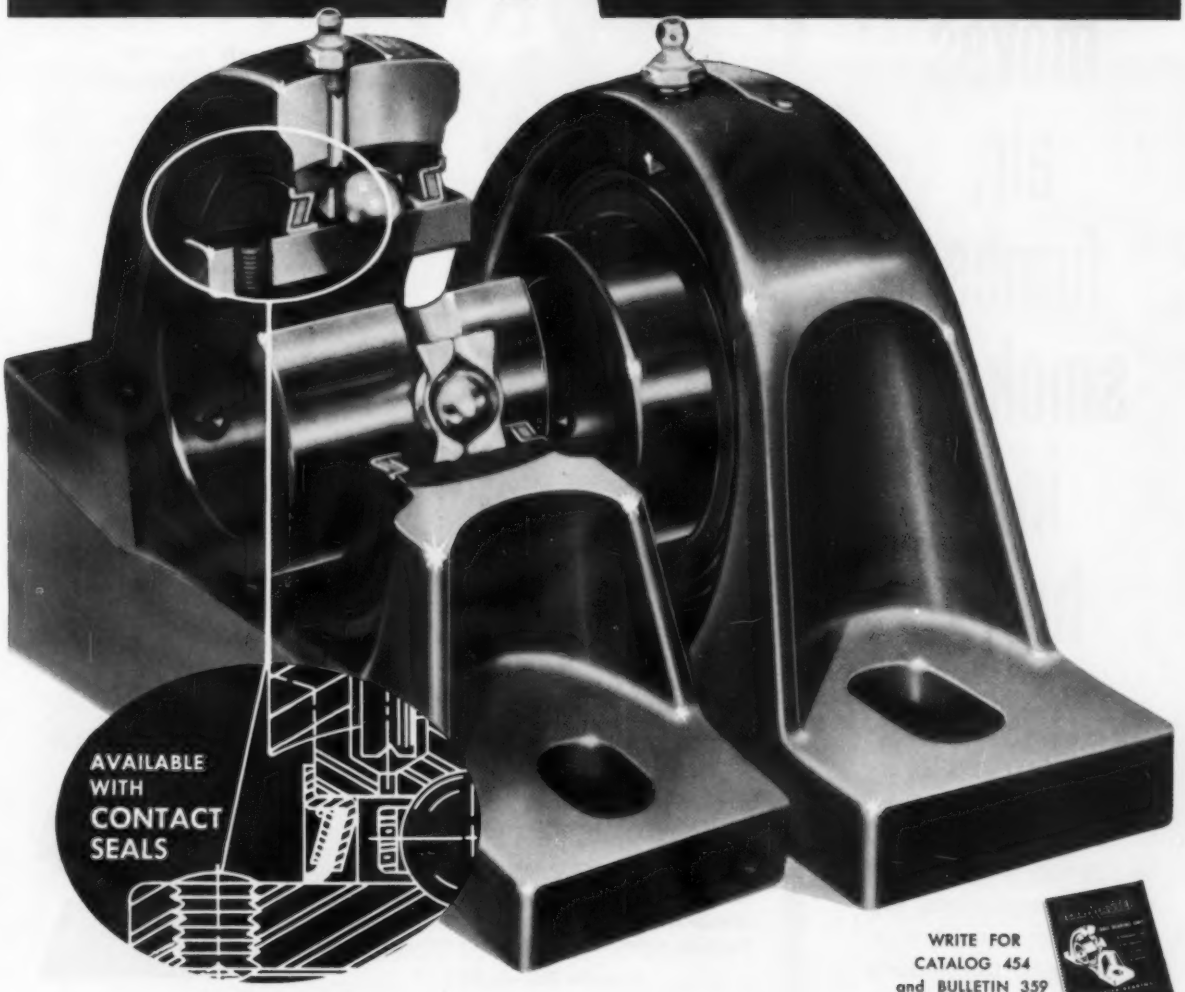

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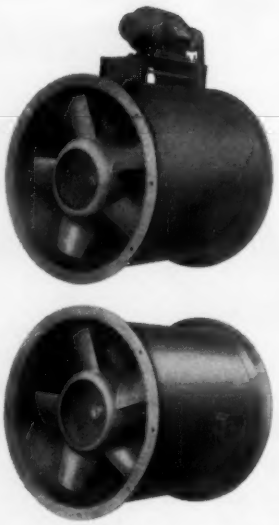

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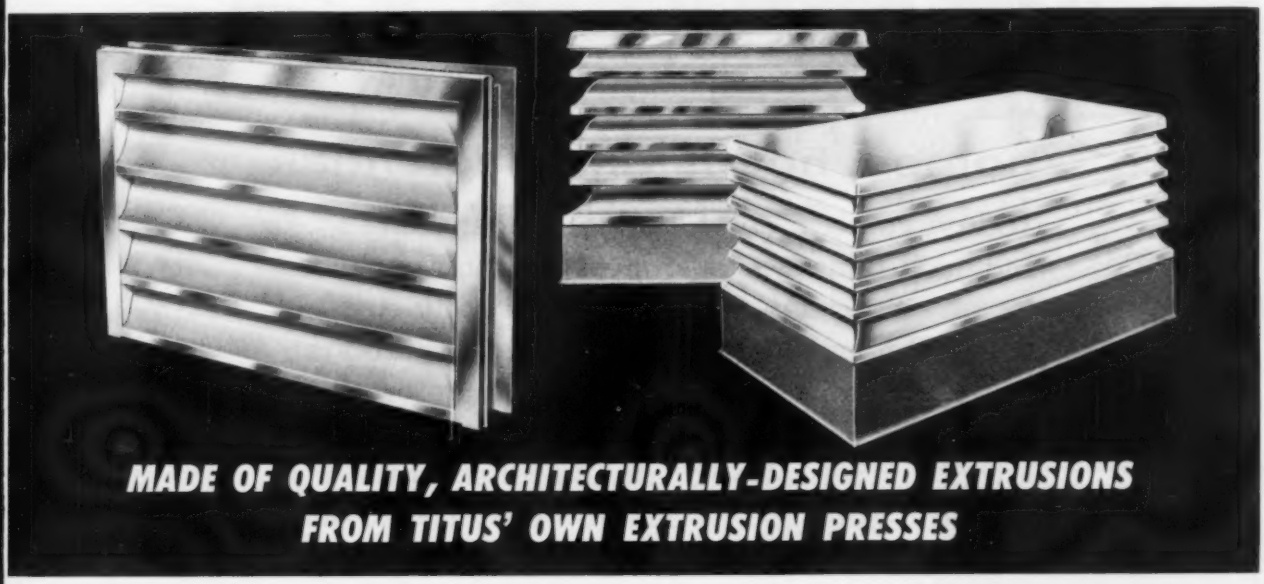
*

A SECRET CODE? No, not at all. *"Oxel" is the name that our most creative and enterprising representatives have affectionately attached to* TITUS EXTRUDED ALUMINUM OUTSIDE LOUVERS. *"Poxel" is the name they have given to* TITUS EXTRUDED ALUMINUM LOUVER PENTHOUSES. The names actually originated from identifying symbols we gave our catalogs on these products. But now everyone's talking "oxels and poxels". That's fine with us. A little humor in business is good. And after all, it is so much easier and faster to write or say "oxels and poxels" instead of TITUS EXTRUDED ALUMINUM OUTSIDE LOUVERS AND LOUVER PENTHOUSES.



MADE OF QUALITY, ARCHITECTURALLY-DESIGNED EXTRUSIONS FROM TITUS' OWN EXTRUSION PRESSES

In *"oxels"* TITUS offers today's finest, most modern line of architecturally designed *extruded aluminum Outside Louvers*. They are rugged, weatherproof . . . and can be installed in any exterior wall opening where a continuous flow of supply air or exhaust air is desired. Available in many louver designs, in 1½", 2" and 4" sizes, in any length. Furnished with aluminum bird or bug screens on back or exterior face of louver if desired.

In *"poxels"* Titus offers the ultimate in clean-cut-looking, rugged, weatherproof, *extruded aluminum Louver Penthouses*. They are the ideal air or exhaust unit for handling ventilation through the roof. Available in square and rectangular shapes . . . in any size specified. Their all-aluminum design practically eliminates maintenance as no frequent paintings or protective coatings are needed.

FREE LITERATURE

MAIL COUPON

TITUS MFG. CORP., WATERLOO, IOWA Branch Mfg. Plants—Hialeah, Florida; Terrell, Texas

Please send new literature on Titus' complete line of
Extruded Aluminum OUTSIDE LOUVERS AND LOUVER PENTHOUSES

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

pumps for air conditioning

homes, hotels and haciendas

Today, you can get a modern, dependable Ingersoll-Rand pump to meet the requirements for air-conditioning installations of any size. In small homes, large homes, hotels, buildings and institutions—regardless of tonnage or head—I-R pumps have proven their economy through low-cost, trouble-free operation. Check with Ingersoll-Rand today. See how easy it is to get a pump that meets your needs exactly!

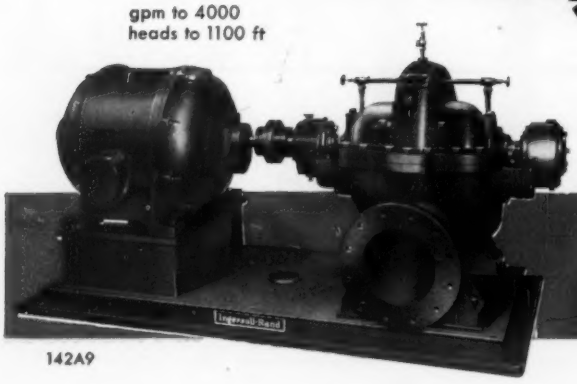
a century 1860 – 1960 *of pump progress*

from the leading manufacturer . . .

Ingersoll-Rand

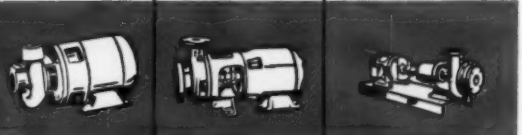
11 Broadway, New York 4, N. Y.

gpm to 4000
heads to 1100 ft



142A9

OTHER I-R PUMPS FOR AIR-CONDITIONING SERVICE



"K" Line Motorpumps | "RV" Line Motorpumps | Cradle-Mounted Pumps

Carnes is first to offer engineers and contractors a completely packaged low-velocity control unit specifically designed to meet the requirements of dual duct low-velocity systems. Carnes Low-Velocity ATC Units . . . where limited space does not demand the smaller duct size of high-velocity systems . . . offer all the advantages of individual room control inherent in dual duct air distribution systems. 2 ATC Ceiling Models — end discharge and bottom discharge in 5 sizes. 2 ATC Window/Perimeter Models — front and top discharge in 2 sizes.

LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION

NEW

Dual Duct Low-Velocity ATC Units

NOW DUAL DUCT COMFORT AT LOW-VELOCITY COST

Carnes Low-Velocity Acoustic Terminal Control Units — ATC — provide "pinpoint" temperature control for specific zones through the flexibility of dual duct air distribution without the need for sealed ducts, high pressure fans and high fan horsepower. Carnes Low-Velocity ATC Units proportion the hot and cold air in response to individual room thermostats . . . blend the hot and cold air for discharge to individual space areas . . . attenuate self-generated noise plus duct-carried noise . . . provide manual volume adjustment.

For complete information, write for Carnes Low-Velocity ATC Catalog 1361.

Carnes also manufactures: High-Velocity ATC Units • Modular, Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • Roof and Wall Ventilators.

CARNES CORPORATION, VERONA, WISCONSIN, / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA

a new and better way to

CLEAN AIR

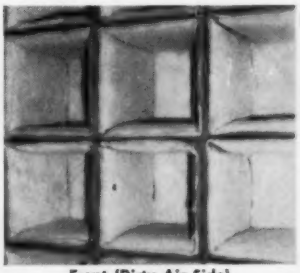
ULOK® Air Filters

Union Carbide research has produced the truly ideal strong, high-capacity filter medium with an irregular, highly-arresting cross section—DYNEL® modacrylic fiber! No other filter medium can touch it for stopping *and holding* unusually large quantities of dust and foreign matter. This dry, un-oiled filter can be vacuum cleaned several times to extend service life even further, if desired.

Proved in scores of major installations—in both new and modified systems—ULOK Air Filters are available in a variety of forms to suit any application.

The Remarkable ULOK Cube-Type Air Filter

Shaped like an open-top box with slightly tapered sides, the ULOK Cube-Type Air Filter with *five filtering surfaces* represents the most efficient filter shape yet perfected. In operation, air flow first carries the dirt particles to the back face of the filter. As dirt collects on the back face, and air resistance increases, air flow is shunted to the four sides, assuring uninterrupted filtration. In addition, the ULOK Cube-Type Air Filter provides far greater filtering surface than conventional filters with equivalent face dimensions . . . and the unique design of the wire basket-type retainers and batt edge assures a tight, leak-proof, press fit.



Front (Dirty Air Side) View of Typical Bank

Rear (Clean Air Side) View of Typical Bank

Advantages: • **Up to 600% longer service life over other throw-away filters due to higher dust-holding capacity** • **22% to 28% National Bureau of Standards atmospheric discoloration efficiency** • **Easier installation—filter is light in weight; no sharp edges or "splinters" to hurt hands** • **Lower labor and maintenance costs; lower inventories because fewer changes are required** • **Easier disposal—simply collapse and discard—leaving dirt *in the bag*** • **14 different sizes suitable for all new, and many existing installations** • **Only $7 to $13 per 1000 CFM of air covers total costs (except labor).**

ULOK Panel-Type Air Filters

Patented method of media formation provides a low-density, three-dimensional batt of high capacity DYNEL modacrylic fiber. Entire face and depth of filter traps dirt particles as inherent strength of medium permits elimination of face supports. Modern ring support provides sure-seal edge and eliminates problem of filter by-pass. Particularly suitable for slide-in applications, and all flat or V-bank installations not adaptable to the Cube-Type Filter. Available in 1" and 2" thicknesses, in 9 different sizes, from 10" x 20" to 24" x 24".

For special applications: ULOK filter media is also available in 2" Pads, 58" x 60"... in ½" Rolls, 58" x 25 yards . . . and in 1" Rolls, 58" x 15 yards.

For complete information on ULOK Air Filters, including efficiency and pressure-drop charts, write for new bulletins.

UNION CARBIDE

UNION CARBIDE DEVELOPMENT COMPANY
Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

ULOK, DYNEL, and UNION CARBIDE are registered trade marks of Union Carbide Corporation

Carnes engineers lick high-velocity split service problems with new simplified all-pneumatic constant volume control. Only Carnes new Acoustic Terminal Control Units offer all these features: positive temperature mixing with integral blender; full acoustic baffling; inch-thick acoustic lining; metal protection on leading edges of lining; flow path not obstructed by perforated material; accurate pressure-drop sensing tips; non-stick, leak-free resilient valve seats. 3 ATC ceiling models — end discharge . . . bottom discharge . . . multi discharge. 2 ATC window/perimeter models — front discharge . . . top discharge. All models are available in single or dual duct with full control selection.

LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION

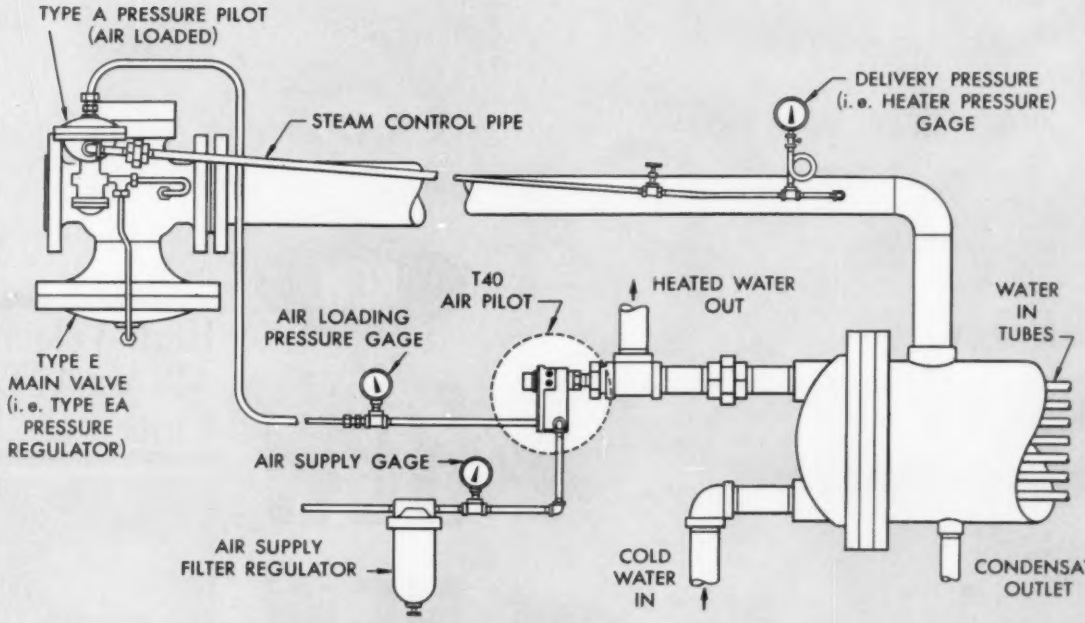
High-Velocity All-Air ATC Units

Carnes Acoustic Terminal Control Units feature new simplified all-pneumatic constant volume control with direct valve to motor connections, eliminating troublesome mechanical devices such as curtains, flappers, bladders, linkages. Carnes new ATC Units assure trouble-free lifetime operation. Investigate now. Write for ATC Catalog No. 1160.

Carnes also manufactures: Low-Velocity ATC Units • Modular, Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • Roof and Wall Ventilators.

CARNES CORPORATION, VERONA, WISCONSIN, / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA

New Spence Temperature Control System Gives Unusual Control Accuracy


TYPE A PRESSURE PILOT (AIR LOADED)
STEAM CONTROL PIPE
DELIVERY PRESSURE (i. e. HEATER PRESSURE) GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
AIR LOADING PRESSURE GAGE
TYPE E MAIN VALVE (i. e. TYPE EA PRESSURE REGULATOR)
AIR SUPPLY GAGE
AIR SUPPLY FILTER REGULATOR
COLD WATER IN
CONDENSATE OUTLET

TYPE EAT40 AIR-CONTROL TEMPERATURE REGULATOR (Patent Pending)

In a recent installation the new Spence air-control temperature regulating system provided:

- ±5°F control accuracy under wide and instantaneous load swings of 210 to 80 gallons per minute.
- Up to 50% reduction in cost as compared to instrument systems of similar accuracy.

This unique cascade-type control with throttling range adjustment independent of maximum heater pressure was developed to meet today's demand for greater control accuracy.

Additional features of the new Spence Temperature Control System include:

- 200°F wide adjustable temperature range
- Adjustable speed of steam pressure change
- Over and under temperature protection
- Pressure limit control
- Fast response
- Very low air consumption
- Field reversible for heating or cooling

The Spence Type EAT Air Control Temperature System, when properly installed, will tame wide ranging, fast changing loads of instantaneous heaters and modern heat exchangers. The cascade principle plus the use of an extremely fast responding bi-metal temperature sensing element reduce time lags and provide control stability.

Here's how the new Spence system operates:

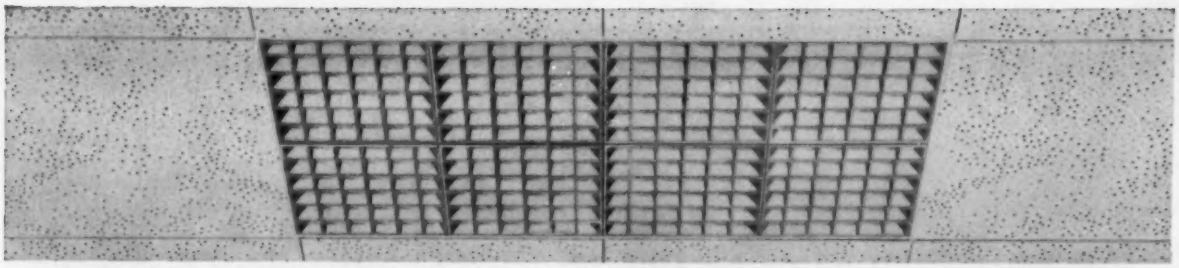
Quick response is based on a bi-metal temperature sensing element. Temperature pilot continuously regulates a loading air pressure.

This loading signal, when applied to a pressure regulator to reflect heater temperatures, causes it to adjust the main valve as changes in load require.

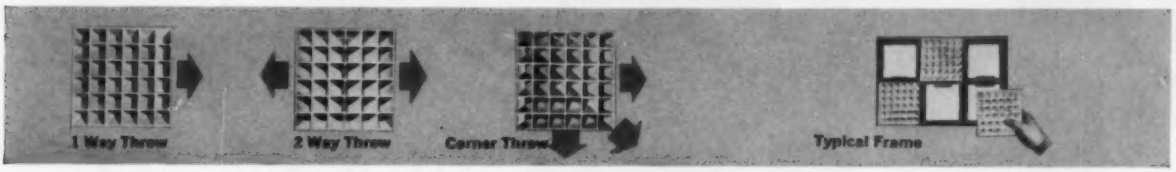
Spence has also developed a new pressure control system based on this same cascade principle. This system has a control accuracy of ½ psi or better from positive pressures through the vacuum range to 30" Hg.

For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

SPENCE ENGINEERING COMPANY, INC.
Walden 1, New York SE-148



LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION

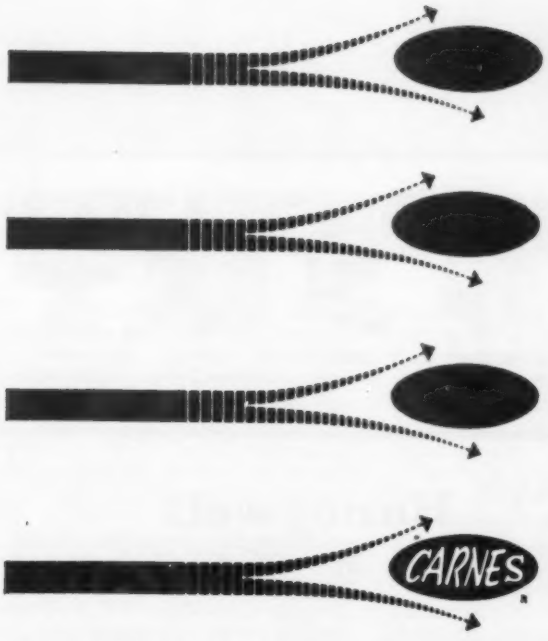


NEW

Modular Diffuser patent applied for

FUNCTIONAL! VERSATILE! UNOBTRUSIVE!

Carnes attractive white Model "M" Modular Diffuser enhances the aesthetic quality of any ceiling. The 6-inch square modules fit virtually flush with ceiling . . . have a minimum of see-through . . . inhibit smudging . . . easily slip in or out for changing air direction or cleaning. An infinite number of patterns and sizes are yours by combining multiples of three modules: 1 way throw, 2 way throw, corner throw. Continuous strip patterns . . . cross patterns . . . alternating patterns may be developed to solve any design or air distribution problem. Module units . . . above windows . . . between fluorescent fixtures . . . around columns or walls . . . butted to light fixtures . . . carry out architectural lines and blend with all ceiling materials. They are equally effective when used as an air return. Modules are made from General Electric's revolutionary new LEXAN, a self-extinguishing, high-impact material that withstands temperatures to 225° without distortion. Frames are available in a wide variety of sizes and types . . . easily joined to make any continuous length or width desired. For complete details, write for Modular Diffuser Catalog No. 460.



Carnes also manufactures Round, Rectangular, Square, Convertible and Baseboard Diffusers • Registers • Grilles • High- and Low-Velocity ATC Units • Roof and Wall Ventilators

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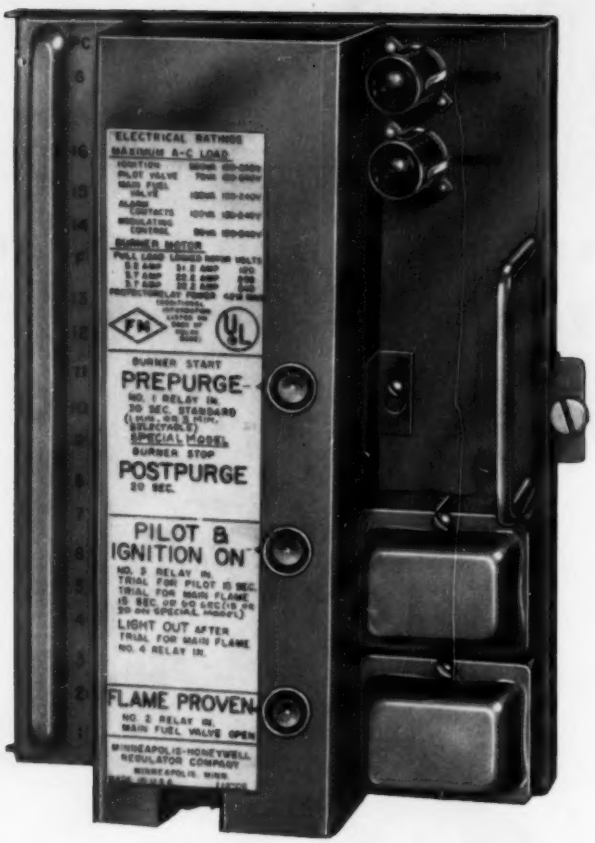
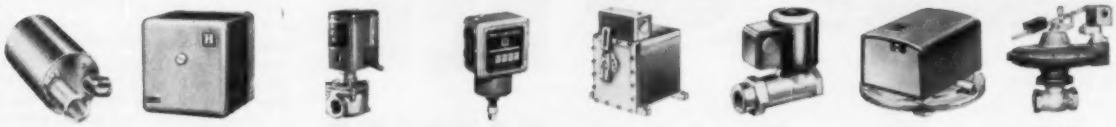


Sequence signaling makes servicing easier

Used on commercial-industrial burners, the Honeywell R478 Programming Relay assures years of safe, dependable operation. New signal lights indicate sequencing and continuity checks for easier servicing.

Honeywell's R478
PROGRAMMING RELAY

Satisfy every flame safeguard need with a quality Honeywell control or system



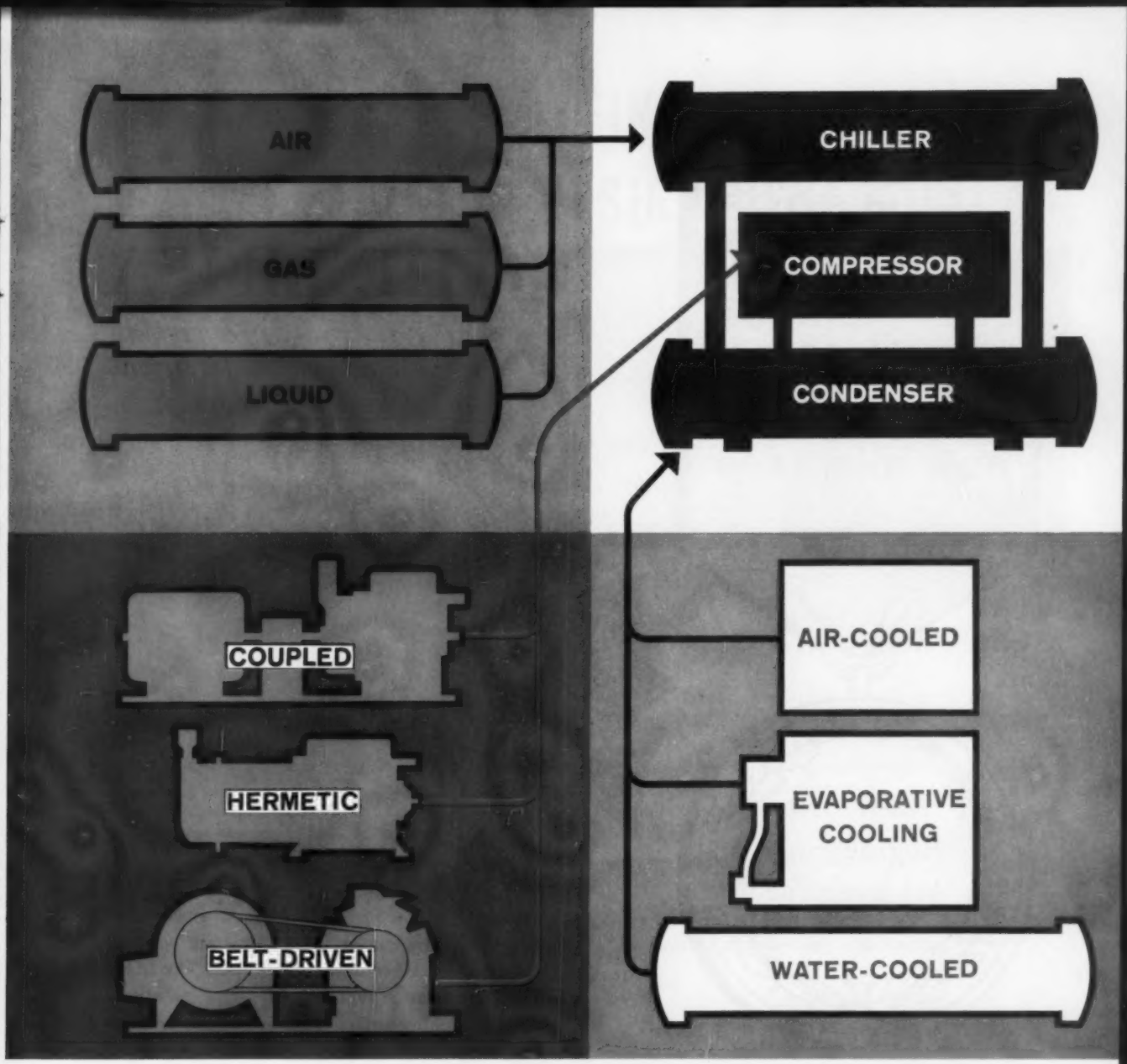
C7012 Ultra-Vision* Flame Detector	RA890 Protectorelay*	V4034 Fluid Power Gas Valve	L404 Pressuretrol*	M931 Modutrol* Motor	V4021 Oil Valve	C645 Pressure Switch	V8004 Diaphragm Gas Valve

For details, write Minneapolis-Honeywell, Dept. AC-6-44 Minneapolis 8, Minn

HONEYWELL INTERNATIONAL
Sales and Service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Honeywell
First in Control
SINCE 1885

*Trademark



"FULL CHOICE" IN CHILLERS

With Worthington you choose chillers with complete flexibility. Chill water for air conditioning, chill brine for process work, chill air for moisture removal. There is never any need for you to compromise job satisfaction when you specify Worthington "Full Choice" chillers.

The coolers are designed for equally efficient heat transfer rates for air and gases, as well as for the conventional liquids. You select the condenser cooling medium—water, air or evaporative cooling. And you have the option of hermetic, coupled or V-belt-driven compressors. Every compressor is from the Worthington V-line. There is no quieter running compressor available today.

Most important—each component is factory-protected for the service involved. Air chillers are complete with properly sized moisture separators and traps. All units are equipped with suction heat separators, to improve over-all efficiency and protect the compressor from damage from liquid slopover.

Standard, factory-installed protective devices include freeze-up switches, crankcase heaters, high-discharge temperature Klixons, pump-down relays, high-low pressure cut-outs and operating gages.

Hermetic compressors are protected additionally by filters, dryers, moisture indicators, low-pressure relief valves and against motor burnout. And, of course, belt-driven units include safety guards.

Result? Worthington's "full choice" of chillers assures you of a reliable, low cost system tailored exactly to your needs.

For full information, contact your nearest Worthington representative, or write Worthington Corporation, Air Conditioning Division, Section 12-46, East Orange, N. J. In Canada, Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

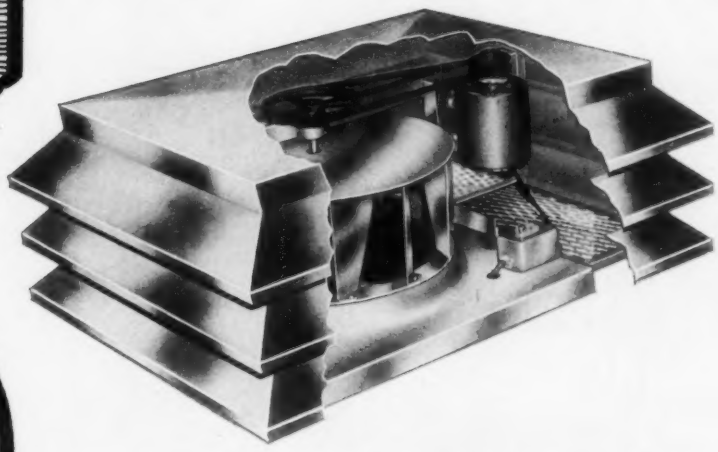
PRODUCTS THAT WORK FOR YOUR PROFIT

The ultimate in ROOF VENTILATOR design that places QUALITY above COST and is now available from PENN!
Engineering Achievement

PENN VENTILATOR *presents*

THE LINEA

A bold linear design concept in roof ventilation . . . featuring matched housings for all requirements . . .



The most respected hallmark of quality in roof ventilation is now the Penn LINEA, a masterpiece of design and engineering performance, worthy of your most valued construction project. The LINEA offers engineers a reputation-building solution to blending architectural requirements with proven air handling principles. Every detail in the construction of the LINEA reflects the newest concepts of modern roof-top ventilation. Corrosion-free aluminum has been used throughout. Louvred, stormproof blades are aerodynamically designed, to reduce friction and turbulence of exhaust air.

Equally important, LINEA housings can be specified for all ventilating needs—high efficiency centrifugal duty, axial supply and exhaust, gravity discharge, pressure relief and other applications. To learn the full, quality story behind the LINEA, send today for your copy of Bulletin L-61 containing specifications and working information . . . or contact your local Penn representative.

PVC

PENN VENTILATOR CO., Inc.

PHILADELPHIA 40, PENNA.

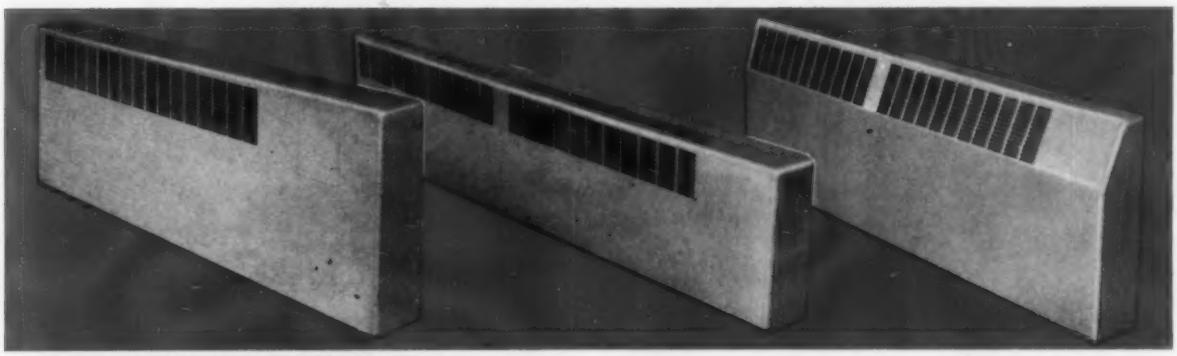
A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

Member of AMCA

Penn Ventilator products are available throughout the Free World.
One of many direct factory representatives at your service:

D. J. CITRON ASSOCIATES, NEW YORK, N. Y.

"Slide'n Snap" FIN VECTOR RADIATES DESIGN VERSATILITY



NOW... DUNHAM-BUSH OFFERS...

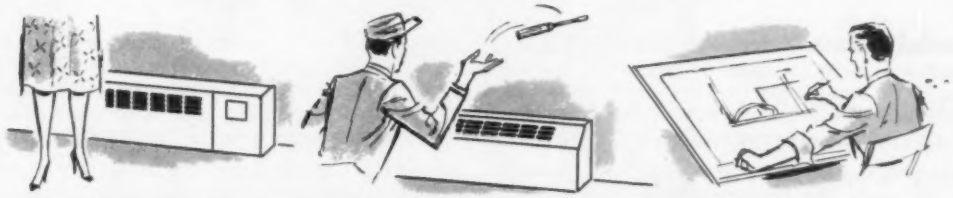
CHOICE OF...FRONT COVER...FRONT/TOP COVER...SLOPING COVER

Completely refashioned to architects' and contractors' specifications, Dunham-Bush Fin Vector full "wrap-around" cover in all three styles introduces exciting possibilities for heating industrial, commercial and institutional buildings.

The new Fin Vector flush mounts, 1, 2 or 3 tiers high. It fits wall-to-wall installation like a glove. Or, Fin Vector can be efficiently employed in separate units as convectors and combined with Dunham-Bush Unit Heaters, Heating-Cooling Units and Convectors . . . for any combination of requirements.

Heating element size selection is a cinch as Dunham-Bush supplies a full range in copper and steel. Ingenious ball-bearing hanger provides "floating action", minimizing noise, at no extra cost.

The new face and features of Fin Vector win quick approval of all concerned with heating . . .



Rounded Corners Complement Sleek Long-Low Design

Architecturally correct in all respects. Whatever the building construction or decoration, Fin Vector presents an attractive, continuous flowing appearance without overlap seams. Louvre design minimizes wall smudging.

Quick . . . Economical . . . Easy Lowest-cost Installation

The time-saving, money-saving secret is "Slide'nSnap" design and installation with a complete package of accessories. Even the hangers snap and lock at the selected proper pitch. No screws in the cover.

The Building Isn't Built That Poses a Problem for Fin Vector

Whether heating's for commercial, industrial or institutional buildings . . . whether room design is simple or complicated . . . whether heat demands are high or low . . . Fin Vector fits.

DUNHAM-BUSH

Send for complete specification details of Dunham-Bush "FC", "TFC" and "SC" Fin Vector Radiation. Request data sheets No. 1258C, No. 1271, No. 1272, No. 1273, and No. 1274.

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES

YORK Turbopak Water Chiller Takes 50% Less Space

—Fits into confined, often-wasted areas

COMPACT, HERMETIC CENTRIFUGAL—A 130-ton Turbopak is only 14′ long, 5′ deep and 6¾′ high, nearly 50% smaller than previous designs. Exclusive Borg-Warner power transmission reduces compressor rotor size to gain space-saving compactness.

COMPLETELY FACTORY PACKAGED—To cut installation costs, the Turbopak is completely factory assembled, insulated, piped, wired, charged, tested. It's shipped and rigged as a single unit—no assembly or refrigeration piping on the job.

AUTOMATIC CAPACITY CONTROL—Pre-rotation vanes provide efficient capacity reduction to 5% of full load. This continuously variable control matches compressor capacity to air conditioning load, assuring maximum system performance.

ULTRA-QUIET OPERATION—Runs more quietly than water pumps that supply it. Quiet, vibration-free operation permits location anywhere. "Push-button" controlled from convenient electronic control center. 65 tons refrigeration and up.

Another YORK Trail Blazer Concept Proved in Action at *Insurance Company of North America, Richmond, Indiana*—
A 125-hp York Hermetic Turbopak supplies chilled water to air condition this modernized office building. Cool, clean, dehumidified air greatly increases the comfort and efficiency of the employees.

YORK CORPORATION
Subsidiary of Borg-Warner Corp.
YORK, PENNSYLVANIA

2306 SOUTH GRANTLEY ROAD, YORK, PENNSYLVANIA

Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Applications

For Your Protection

SPECIFY • INSTALL

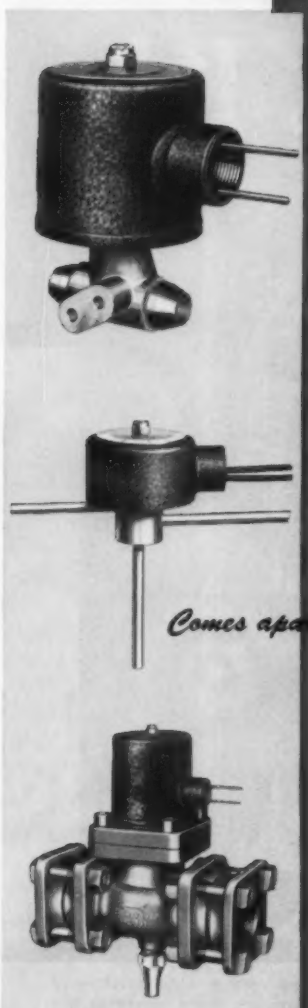
ALCO
SOLENOID VALVES

FOR POSITIVE CONTROL

ALCO'S HIGH QUALITY

Guarantees Maximum Life

- Constructed both for hermetic and non-hermetic applications.
- Manufactured of the best grades of corrosion-resistant Materials.
- Alco's Cool, POWER-PACKED coils are moisture proof impregnated.
- Special coils available for high ambients.
- Positive closing with pressure tested seating for POSITIVE SHUT-OFF.
- All MANUFACTURED by ALCO to ALCO'S high Quality Control Standards.



Comes apart easily in the line for cleaning

More than **250** models for every control application:

LIQUID • SUCTION
HOT GAS • WATER
STEAM • AIR

Call your ALCO WHOLESALER, WRITE for Specifications Section 173-61.

ALCO VALVE CO. 861 Kingsland Ave. · St. Louis 30, Mo.

BUY SECURITY • BUY QUALITY • BUY ALCO

8222-2

The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors • Solenoid Valves Refrigerant Filter-Driers • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves

CANADIAN AGENT: A. C. & R. Products Ltd., 2857 Lawrence, E. Scarborough, Ontario.
Excluding the provinces of British Columbia and Alberta.

Armstrong Department Store
Cedar Rapids, Iowa

Install It and Forget It!

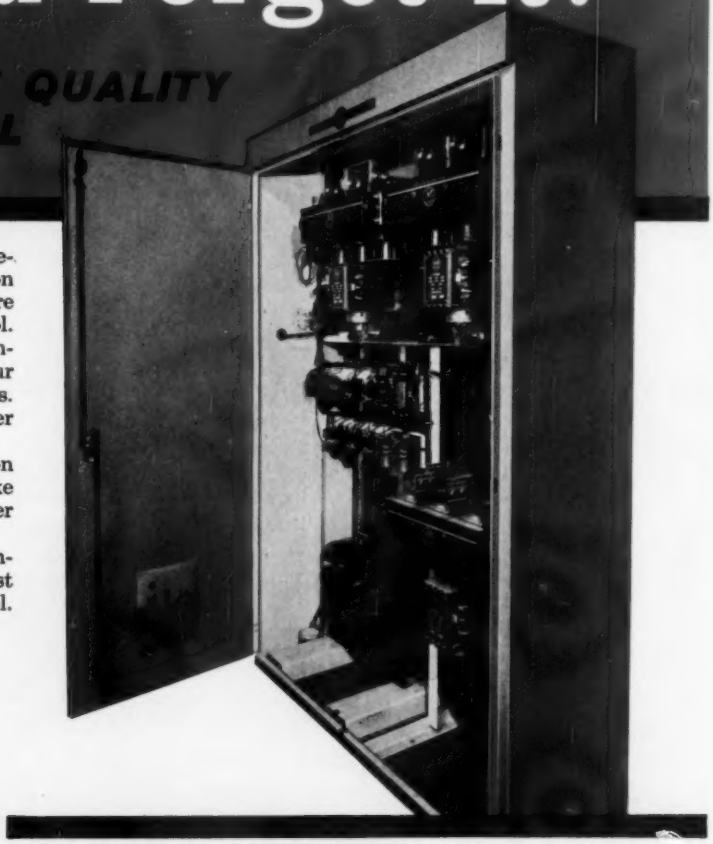
ALLEN-BRADLEY QUALITY MOTOR CONTROL

Consistent reliability "on the job"—the experience gained over many years—is the reason more and more air-conditioning engineers are specifying Allen-Bradley *quality* motor control.

The simplicity of Allen-Bradley solenoid control—there is only ONE moving part—is your guarantee of *millions* of trouble free operations. The double break, silver alloy contacts never need service attention.

The appearance and the rugged construction of all A-B air-conditioning control will make both the specifying engineers and the owner proud of the installation.

For trouble free, maintenance free performance—that's measured in *years*—always insist on the best—Allen-Bradley *quality* motor control.



This Allen-Bradley Bulletin 1277 reduced voltage autotransformer starter, installed in the Armstrong Department Store, operates the 300-ton air-conditioning compressor motor. Has closed circuit transition, and meets power company requirements for acceleration without causing light "flicker."

Project Designers: Alvin L. Weidt & Associates, Minneapolis, Minn.
Electrical Contractor: Acme Electrical Company, Cedar Rapids, Iowa

A-B Bulletin 798 control center—which contains the combination starters for the auxiliary equipment.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
Member of NEMA

QUALITY MOTOR CONTROL

how to use gas-fired duct furnaces most profitably

Free from Reznor: the third in a series of new Reznor Heating Handbooks, "Commercial and Industrial Applications of Duct Furnaces." Duct furnaces offer a relatively new way of heating through air distributing systems. They provide all the economies of direct fired heaters, yet may be located at a distance from the space to be heated. Installation is easy — just connect gas pipe, power, and a vent.

To use duct furnaces most advantageously requires some knowledge of special considerations involved in specific commercial and industrial applications.

That's the purpose of this new handbook, published by Reznor, the world's largest manufacturer of gas unit heaters. It tells about the various ways Reznor duct furnaces can be used for heating or in combination with cooling systems. Also included are illustrations, load calculating data, and practical suggestions to help you get better heating at lower cost.

For your copy, mail the coupon to Reznor. And for more information on Reznor heaters, call your distributor or nearby district office listed in the Yellow Pages under "Heaters-Unit".

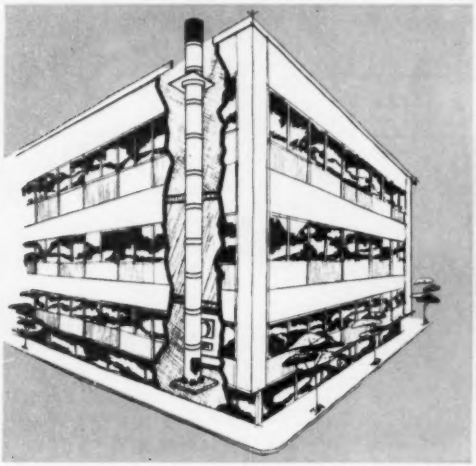
REZNOR HEATERS

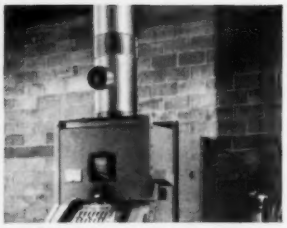
REZNOR MANUFACTURING COMPANY
Dept. HPA-6, Mercer, Pa.
Send me a copy of "Commercial and Industrial Applications of Duct Furnaces".

name_____ title_____
company_____
address_____
city_____ state_____

FLINTKOTE® **VAN-PACKER®** Refractory Industrial Stacks

Solving Industrial Stack Problems





Van-Packer stack is easily installed inside most buildings. Its use permits greater freedom of location for the boiler or incinerator. The Van-Packer Model HT stack is the only commercial or industrial stack listed by Underwriters' Laboratories, Inc.

Underwriters' Laboratories, Inc.® INSPECTED Van-Packer Model HT Smokestack

Van-Packer industrial stack is easily located inside tall buildings

More and more architects and designers are specifying Van-Packer industrial stacks to simplify design requirements of their buildings and at the same time permit greater floor plan flexibility and more pleasing architectural effects.

Factory-built of 3-foot insulating refractory sections, the Van-Packer Model HT stacks can be located anywhere inside (or outside) the building to handle virtually any commercial or industrial incinerators as well as boilers or furnaces. You need allow only a 4-inch clearance to non-combustible construction to meet Underwriters' Laboratories specifications. Where the stack passes through combustible floors, a special insulating refractory thimble fits around the stack section and requires no additional clearance. This thimble is also used together with the Van-Packer flashing and counter flashing where the stack passes through combustibles at the roof.

Van-Packer stack sections are encased in an aluminized steel jacket which needs no routine painting or maintenance. Thus, your design can be made with minimum provision for stack accessibility.

The Van-Packer stack can be installed on concrete or brick pier foundations, floor supported, supported by wall brackets, or super-imposed directly on the incinerator or boiler. Where breechings are required, merely specify a Van-Packer straight section for that purpose. It is easily connected to the tee section opening, which has inner diameter equal to that of the stack.

Van-Packer stacks are available in sizes to meet virtually all application requirements, with these inner diameters: 10, 12, 15, 18, 21, 24, 30, and 36 inches. Cost of a Van-Packer is about the same as a steel stack for a comparable application, yet the non-corroding refractory construction results in an average life three times longer. Draft provided is equal to that of equivalent brick stacks (greater that that of equivalent steel stacks), assuring more efficient operation of the equipment served.

Van-Packer Model BF® stack for boilers and furnaces

In addition to the UL-listed Model HT stack which handles incinerators with flue gas temperatures up to 1800°F (up to 2000°F for occasional brief periods of forced firing), Van-Packer also offers the Model BF stack (not UL listed). This low cost refractory stack is ideal for boilers and furnaces with flue temperatures to 800°F. It is identical to the Model HT stack except for the refractory formula used in casting the stack sections, and is available in the same inner diameters.

For complete information on Van-Packer industrial stack, write for Bulletin IS-49.

For residential use, specify Van-Packer all-fuel chimney

Here's a low-cost, factory-built tile-lined residential chimney that's safe and attractive. Specify either metal or asbestos-cement housing with embossed brick design. Choice of four non-fade brick colors: red, white, buff, and gray. Factory-built 2-foot flue sections have 5/8-inch fire clay tile liner, 3-inch vermiculite-concrete insulating wall, and asbestos-cement outer jacket. Van-Packer chimney is UL-listed for all fuels, is safe for incinerators. Write for Bulletin RS-1.

FLINTKOTE® **VAN-PACKER®**

The Flintkote Company

Manufacturers of Diversified Products for Home and Industry

30 Rockefeller Plaza, New York 20, N. Y. Phone: PLaza 7-5500

In the West: Pioneer Division, The Flintkote Company, P. O. Box 2218, Terminal Annex, Los Angeles, Calif.

In Toronto, Ontario: The Flintkote Company of Canada, Ltd.

STOP WASTING DOLLARS... SPECIFY RAY BOILERS

DESIGNED TO SAVE YOU MONEY

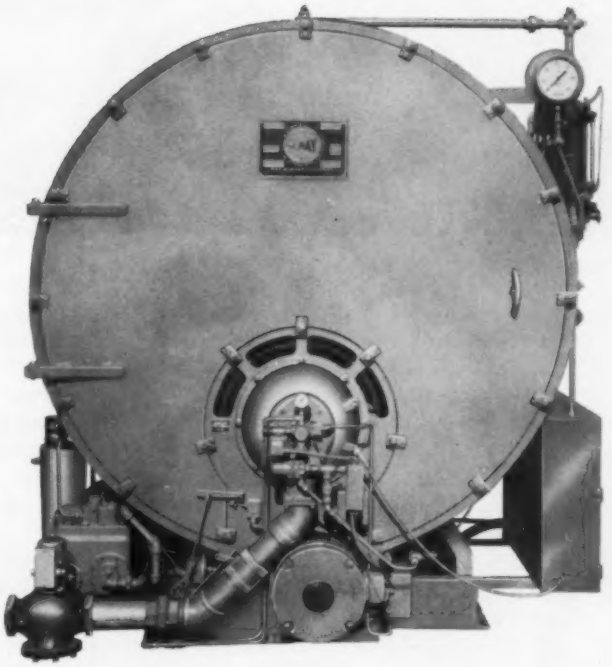
When it comes to efficiency, a good three pass packaged boiler will provide about 80% conversion of fuel to steam. Our Ray Packaged Boiler does better than this on the efficiency end, and gives you the added advantages of full fuel modulation, the exclusive Ray Viscosity Valve, throttled back operation, and self-monitoring electronic controls. These added Ray features mean dollars saved in the form of constant, surge-free fuel delivery, and peak fuel economy.

Ray Packaged Boilers are designed for automatic operation and quick inspection, with maintenance costs reduced to a minimum. They are easy to install, and fully insulated against noise. The result is a soundly engineered, competitively priced unit of outstanding quality, serviced by one of the most complete dealer organizations in the world. You'll find your Ray Dealer in the Yellow Pages of your 'phone book.

From the world's first horizontal rotary oil burner, introduced by Ray, to the latest in packaged boiler systems, Ray's 89 years of experience guarantees you the most reliable products available in the field of combustion equipment.

Chosen for Reliability and Economy

Two 50 h.p., 30 p.s.i. straight gas fired Ray Packaged Boilers were selected for the R. L. Spitzley Company, Saginaw, Michigan. Space saving design, the ability to run on reduced gas pressure, and low operating noise level were major factors in the choice of Ray Packaged Boilers.



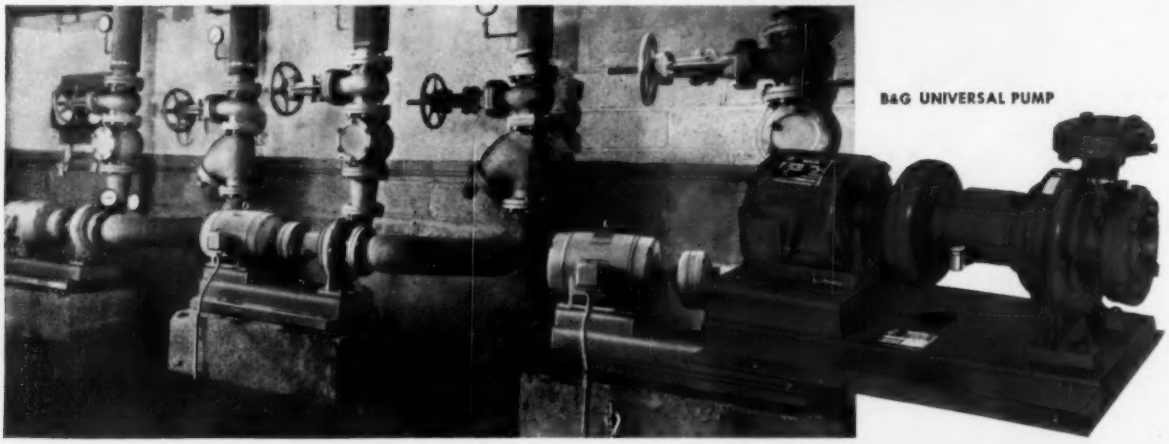
LEADERS IN THE FIELD OF COMBUSTION EQUIPMENT SINCE 1872

THE BOILER WITH AN INTERNATIONAL REPUTATION

RAY BURNER CO.
BOILER DIVISION
1301 SAN JOSE AVENUE
SAN FRANCISCO, CALIFORNIA
4024 FILBERT STREET
PHILADELPHIA 4, PENNSYLVANIA

B&G® PRIMARY AND SECONDARY PUMPING METHOD IDEAL FOR GARDEN APARTMENTS

Architect: Offices of Irwin S. Chanin, New York City
Mechanical Engineer: Cosentini Associates, New York City
Mechanical Contractor: Murphy and Ryder, New York City
Builders: Dyker Building Co., Inc., New York City



B&G UNIVERSAL PUMP

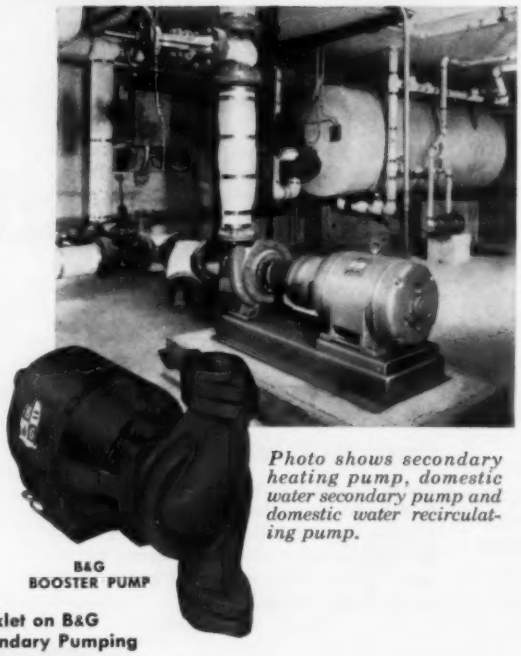
Battery of B&G Universal primary circulating pumps

At Green Acres Garden Apartments, Valley Stream, N.Y., 61 two-story units containing 294 apartments are heated by a B&G *Hydro-Flo* forced hot water baseboard system. The system is designed for primary and secondary pumping, a method conceived and developed by B&G engineers.

Where multiple buildings or multiple zones are to be heated with circulated water this pumping method *reduces the pump horsepower required, improves heat control and saves fuel.*

A typical system consists of a primary main, continuously circulated by a B&G Universal Pump, with smaller B&G Pumps drawing on the primary main to supply separate heating zones. Each zone pump is under individual thermostatic control, so that each zone can be supplied with exactly the amount of heat required by its function or exposure.

The Green Acres installation has six secondary heating zones and six domestic water zones.



B&G BOOSTER PUMP

Photo shows secondary heating pump, domestic water secondary pump and domestic water recirculating pump.

B&G SERIES 1522 PUMP

Send for booklet on B&G Primary and Secondary Pumping

BELL & GOSSETT
COMPANY
Dept. GR-5, Morton Grove, Illinois

® *Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario*

JANITROL

presents the new and versatile

52 series

AIR-COOLED
AIR-CONDITIONER

A PRACTICAL APPROACH TO ECONOMICAL,
HIGH EFFICIENCY COOLING FOR COMMERCIAL—
INDUSTRIAL BUILDINGS . . .

advance designed for the future

NEW JANITROL 52 SERIES AIR COOLED AIR CONDITIONERS

Outwardly beautiful and pleasing to the eye, inwardly rugged and powerful, new Janitrol 52 Series units combine years-ahead styling and cooling performance . . . provide truly low-cost central cooling with matchless reliability and performance.

JANITROL'S ADVANCED DESIGN . . . A SAFEGUARD AGAINST PRODUCT OBSOLESCENCE!

The weatherproof, high-efficiency 52 Series condensing unit, containing all moving refrigeration parts, installs outside. Available in six basic capacities from 22,200 to 110,200 btu/hr.

Full A.R.I. certification: Every Janitrol unit meets all standards of Air Conditioning and Refrigeration Institute.

STANDARDS OF EXCELLENCE . . .

In Performance—large condensing coils assure efficient operation with outdoor temperatures up to 125°F!

In Styling—crisp, modern lines distinguish the new 52 Series. Cabinets are finished in durable, automotive-type enamel.

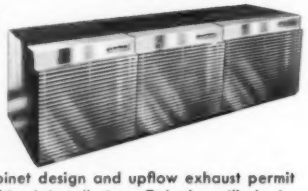
In Economy—The top-mounted fan bathes condensing coils in a jet stream of cooling air to raise efficiency and reduce current usage. Coils are shaded from the sun by louvers.

In Quietness—The powerful compressor is mounted on rubber-cushioned, resilient springs . . . cabinet is heated with special sound-deadening material.

In Safety—Complete overload and weather protection is provided. Enclosing grilles thoroughly safeguard children and pets.

In Servicing Ease—all components are easily accessible. Service panels can be removed without effecting operation during service checks.

MULTIPLE COMBINATIONS PROVIDE ECONOMICAL, HIGH CAPACITY COOLING



Modular cabinet design and upflow exhaust permit compact, multi-unit installations. Only the grilled, air-intake side of the cabinet requires clearance.

Any desired number of Janitrol 52 Series units may be installed together, with zero clearance between, to provide a variety of higher capacity combinations from 120,000 to over 1,000,000 btu/hr. Only Janitrol offers custom-built capacities at standard model cost!

JANITROL®
HEATING AND AIR CONDITIONING

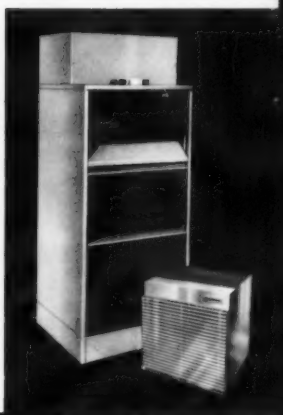
M-R MIDLAND-ROSS CORP.

A DIVISION OF MIDLAND-ROSS CORP. • COLUMBUS 16, OHIO
IN CANADA: MOFFAT HEATING & AIR CONDITIONING DIVISION
MOFFATS LTD., TORONTO 15

ALSO MAKERS OF SURFACE INDUSTRIAL FURNACES, KATHABAR HUMIDITY CONDITIONING, JANITROL RESIDENTIAL HEATING AND COOLING EQUIPMENT

JANITROL
year 'round conditioner

Combines quality gas heating and waterless cooling! Less than four sq. ft. of floor space needed for most installations. Features include famous Dura-Tube heat exchanger with 20-year warranty. Unique by-pass for correct air flow on heating or cooling cycle without adjustments. Powerful air-cooled 52 Series condensing unit. ADD-ON cooling—install for heating only, add cooling later.

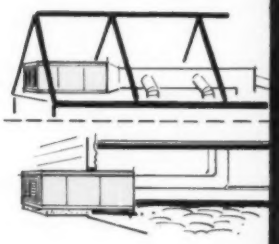


ADD-ON COOLING

Adapts most any warm air furnace for thrifty, efficient central cooling. Cooling coil mounts in duct, attractive, air-cooled 52 Series unit goes outside. Powerful, quiet performance with outside temperatures to 125°F. Easy to install.

"J-LINE" self-contained conditioners

An economical solution for many cooling needs. One compact unit contains blower, compressor and coils. For use with ducts or as free discharge. Install through wall in crawl space, attic or other limited access locations.

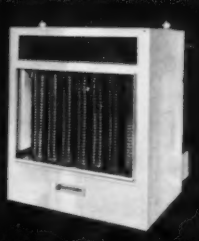


BLOWER-COIL UNITS

Smartly styled cabinet contains cooling coil and blower for use as free discharge or with ducts. Units are attached to ceiling to save floor space. Very quiet and efficient!

GAS-FIRED DUCT FURNACES

For installation in a duct where the air is circulated by a separate blower. Especially adaptable for industrial heating applications in combination with cooling. 73 Series in six sizes from 50,000 to 225,000 btu/hr. 72 Series in sizes 200,000 and 300,000 btu/hr. may be combined to provide unlimited capacity range.



Drainage lines, heating and air-conditioning lines, fire lines—all Bethlehem Steel Pipe* in New York's "city in the sky"

Pan Am Building, the world's largest commercial office building, is scheduled for completion in late 1962. Rising 59 stories tall, on a site directly behind New York's Grand Central Station, it will house a population of 25,000 people working in nearly 22,000,000 cubic feet of air-conditioned, fire-protected comfort.

**Continuous Buttweld to 4 in., nom. Electric Resistance-Weld to 16 in., OD*

Owner: Grand Central Building, Inc.; Erwin S. Wolfson, President; Jack Cotton, Chairman. Architects: Emery Roth and Sons. Design Consultants: Walter Gropius; Pietro Belluschi. Structural Engineer: James Ruderman. Mechanical and Electrical Engineers: Jaros, Baum and Bolles. General Contractor: Diesel Construction Company, Inc.; Carl A. Morse, President. Heating and Ventilating Contractor: Raisler Corp. Plumbing Contractor: Jarcho Bros. Pipe Jobber: Chas. F. Guyon, Inc.

Write for our Handbook of Tubular Products 383-C.

Steel

for Strength ... Economy ... Versatility

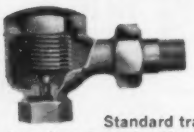
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

ONE STOP SHOPPING FOR AND AIR CONDITIONING

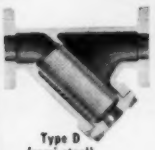
SARCO RADIATOR TRAPS, TYPE H



Sarco Type H Radiator Trap, angle pattern

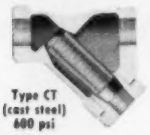
Standard traps for all types of two-pipe steam heating systems. Suitable for pressures from highest vacuum to 25 psi. Require no adjustment in service. Removes air and condensate from radiators or convectors rapidly, completely, without steam waste or noise. Vertical traps are designed for bottom connected convectors to facilitate installation and cleaning.
Bulletin No. 155

SARCO PIPELINE STRAINERS



Type D (semi-steel) flanged, 125 and 250 psi

Types AT (semi-steel) 250 psi and BT (brass) 250 psi



Type CT (cast steel) 600 psi

For condensate, steam, water, oil, air, gas, and other piped fluids

Effective, inexpensive insurance against costly shutdowns and heavy repair bills. Installed ahead of the equipment, they protect the working parts of temperature and pressure regulators, steam traps, pumps, meters, burners, compressed air equipment, hydraulic systems, lubricators, and nozzles.

Standard screen used in Sarco strainers is constructed to prevent particles from by-passing the screen at the ends.

Rigid construction prevents rupture of screen when sediment creates abnormal pressure differentials. No weave-crevices to trap particles, and, therefore, more readily cleared by the use of the blow-down connection.
Bulletin No. 1210

SARCO BALANCING FITTINGS

Type 10 Series Angle Union Pattern Thread Type

Type 40 Series Straightway Union Pattern Sweat Type

Type 50 Series Straightway Screwed Pattern

Type 60 Series Straightway Soldered Pattern

For balancing branch or circuit resistance of radiators, convectors, heating or cooling coils, unit heaters, and other heat transfer surfaces employing hot or chilled water. Unique solid segment stem assures linear straight line flow not obtainable with butterfly stems. Maximum water pressure 200 psi cold liquid—non-shock; 175 psi, 250°F. temperatures.

Available either in standard construction or with integral manual air vent in 3 standard patterns: angle union, straightway union, and straightway female connection. Both screwed end and sweat types. Twenty-six different patterns and sizes.

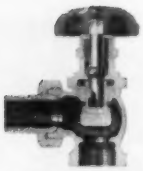
Bulletin No. 225

SARCO HIGH CAPACITY AIR ELIMINATORS FOR WATER

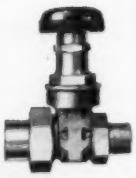
Type 13W For Water Heating and Cooling Systems

Type 13W and 13WH vent air from radiant or hot water heating systems, high pressure, high temperature hot water lines, chilled and condenser water lines in air conditioning installations, and process liquid lines — eliminate air pockets that prevent or retard circulation. Float-controlled discharge valve vents air rapidly through large orifice. Float action prevents escape of fluid.
Maximum pressure ratings: No. 13W — 150 psi; No. 13 WH — 300 psi.
Bulletin No. 170

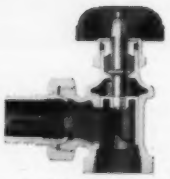
SARCO VALVES FOR WATER



No. 37 Quick-Opening



No. 129 Convector and Radiator Gate



No. 157 Sleeve Type

No. 127 Convector and Radiator Gate

No. 167 Sleeve Type

Bulletin No. 225

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

QUALITY HOT WATER, STEAM, SPECIALTIES...FROM SARCO

SARCO FLOAT-THERMOSTATIC STEAM TRAPS FOR 0-15 PSI

Type FT ¾", 1", and 1¼" Bodies and covers of semi-steel (rated at 125 psi). Stainless steel valve and mechanism.

Type FTL 1½" and 2" Bodies and covers of semi-steel (rated at 125 psi). Stainless steel valve seats. Renewable bronze valve heads.

Sarco Float-Thermostatic steam traps discharge condensate at steam temperatures continuously and without shock. Air binding impossible — separate thermostatic air vents remove automatically and continuously all air and incondensable gases reaching the trap. Balanced pressure vent self-adjusts to all operating pressures, and location above condensate level permits discharge of air and gases reaching trap after start up. Do not require adjustment when pressures change.

Bulletins No. 450 & 455

SARCO AIR ELIMINATORS FOR STEAM

For Low Pressure Steam Heating Systems

Type 6, 6T, and 13-S Air Eliminators vent air from radiators and piping rapidly and completely. Float valve design prevents spillage. Check valve prevents air return under vacuum.

Types 6 and 6T have brass heads and seats, cast iron body. Body of 13-S is semi-steel with stainless steel head and seat. Pressures to 15 psi.

Bulletin No. 170

Type 13-S Air Eliminator

Type 6 Air Eliminator

SARCO DOMESTIC WATER BLENDERS, TYPE DB

Maximum Working Pressure, 125 psi

Designed for use with submerged heating coils in residence or apartment heating boilers and external submerged coil heaters piped to heating boilers, where the pressures on cold and hot water supplies are balanced. Because the water in the boiler varies in temperature with the steam pressure carried, or the heating load, service hot water may be delivered to the fixtures at boiler water temperature.

The DB blender prevents this by automatically adding enough cold water to the hot discharge from the heater coil to maintain the desired moderate water temperatures to the fixtures.

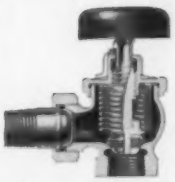
Adjustable between 120°F. and 160°F. Any other range, covering 40°F. can be supplied at extra charge.

Bulletin No. 800

SARCO RADIATOR VALVES FOR STEAM

Gate Valve, Reinforced Packless Bonnet

129 — Double wedge disc convector gate valve with female union inlet, male threaded outlet. Max. pressure — 60 psi.

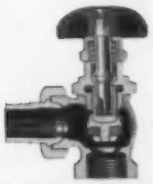


Bellows Packless Radiator Valve

45A — Valve stem positively sealed by flexible bellows of heavy-wall, helically-corrugated, bronze tubing. Modulating, non-modulating, and lock-shield types, angle and straightway patterns. Max. pressure — 25 psi.

Gate Valve

127 — Double wedge disc gate valve, female union inlet, male threaded outlet. Can be repacked under pressure. Available in a variety of connections. Max. pressure — 125 psi.



Reinforced Packless Bonnet

1141 — Vapor-tight stem, quick-opening, non-rising, with renewable composition cone disc. Max. pressure — 60 psi.

Bulletin No. 225

Plus . . . SARCOTHERM TEMPERATURE CONTROL SYSTEMS

These outdoor weather-compensated heating control systems are custom planned for schools, office buildings, hospitals, apartment buildings, developments.

- Maintain uniform inside temperature by automatically adjusting flow of hot water or steam to compensate for changes in outdoor temperature and room load demand.
- Insure low installed cost . . . with fewer controls, less wiring.
- Special drawings furnished for each job. On-the-job assistance from Sarcotherm's field engineers.

ALSO AVAILABLE: steam traps, Sarcofin and Sarcopak radiation, access boxes, temperature controls, vacuum and condensate pumps, and thermometers.

5924

SARCOTHERM

SARCOTHERM CONTROLS, INC.
AN AFFILIATE OF SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.

CONTROL SYSTEMS FOR STEAM, HOT WATER, AND RADIANT HEATING

Mr. Kurt C. J. Monier, President, A. J. Monier and Company, Inc., mechanical contractor for the United Services Automobile Association building, San Antonio, says:

"We found just the in the Honeywell

Mr. Monier and Col. R. C. Singer, U. S. Army, Ret., USAA Building Superintendent, observe work on the new wing. The Honeywell Selectographic installation will help tie the air conditioning systems of the two buildings together.

flexibility we needed Selectographic"

UNITED SERVICES AUTOMOBILE ASSOCIATION
ARCHITECTS: Atlee B. & Robt. M. Ayres
ASSOCIATED ARCHITECTS: Phelps & Dewees & Simmons
MECHANICAL ENGINEER: G. M. Baker
MECHANICAL CONTRACTOR: A. J. Monier and Company, Inc.

The Selectographic DataCenter* at USAA will centralize air conditioning control in the present building and new wing, and can easily be expanded to handle future additions as well.

"Selectographic's built-in flexibility made it a natural for the USAA job," says Mr. Monier. "When the company planned their new wing, they decided to centralize control of the air conditioning system to cut operating costs and assure maximum comfort. Ultimately, they want to supervise air conditioning in the present building from the same control center. They also want the panel to assimilate controls for all future additions. Selectographic, with its modular construction and system-by-system supervision, will handle the job perfectly."

The Honeywell Selectographic DataCenter at USAA enables one man to supervise the entire air conditioning system from the engineer's office. He can read and adjust temperatures, start and stop equipment, and perform other necessary functions merely by pressing buttons on the electronic console. Air conditioning in the present building will be supervised from this same set of controls.

Whatever your temperature control needs, Honeywell can satisfy them best. Honeywell is the *only* company that designs and manufactures all three types of control systems —pneumatic, electric and electronic. And Honeywell backs up every system with accurate specifications, prompt delivery and supervised installations. For details, call your nearby Honeywell office. Or write Honeywell, Dept. AC-6-141, Minneapolis 8, Minn. In Canada, write Honeywell Controls, Limited, Toronto 17, Ont.

**Trademark*

This is the type of Selectographic DataCenter that is being installed in the USAA building. The permanent graphic diagrams, pilot and alarm lights, instruments and switches around the console are all enclosed in standardized modules. Additional controls can easily be added in units that match the original panel perfectly.

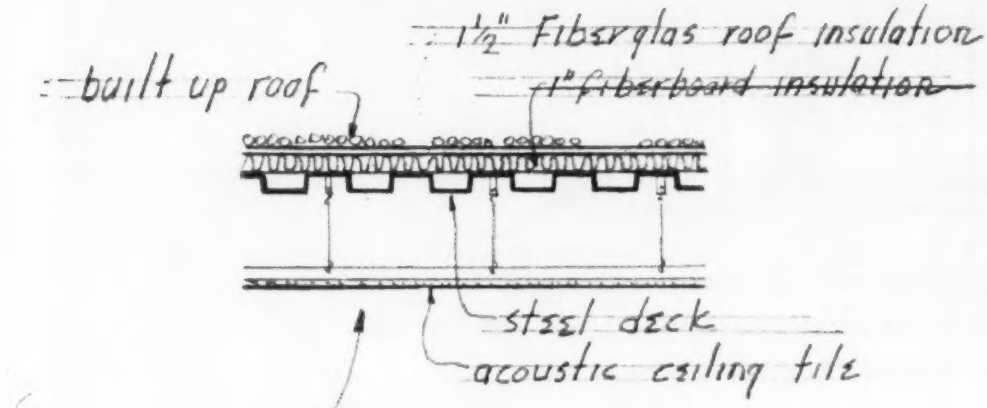
Honeywell

HONEYWELL INTERNATIONAL Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

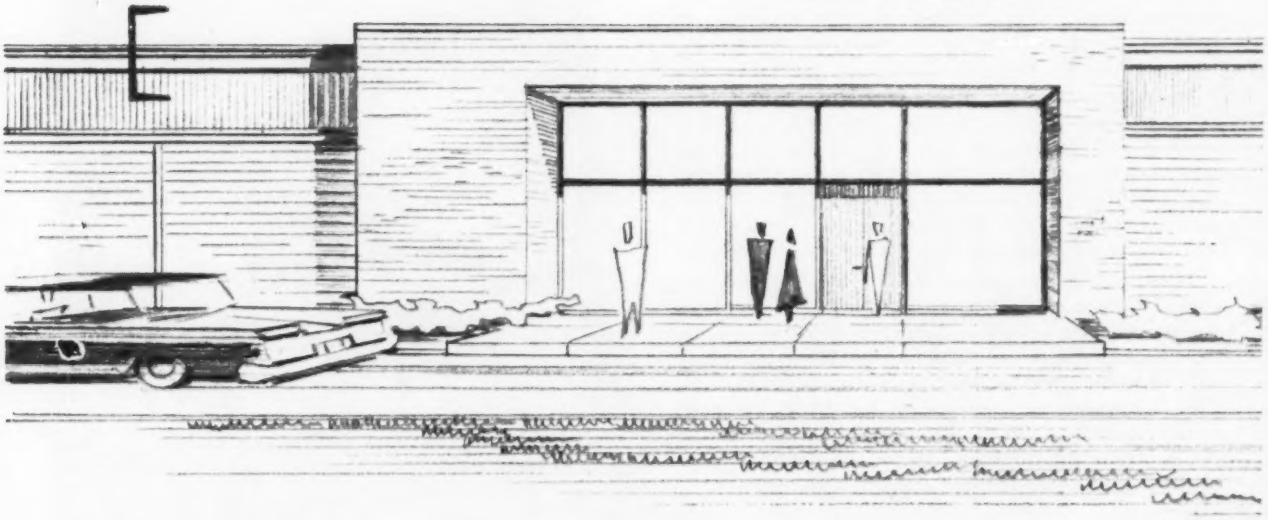
H HONEYWELL *First in Control*

DIVIDEND ENGINEERING*

FORECASTS AN $8,000 SAVING IN INITIAL COSTS AND $1,800 IN YEARLY OPERATING COSTS AT NEW SPEIDEL PLANT AND RESEARCH LABORATORY



***DIVIDEND ENGINEERING** *is a service Owens-Corning will provide to demonstrate to builders, designers, management and financial groups that optimum use of Fiberglas materials can result in reduced initial and operating costs and improved building performance.*



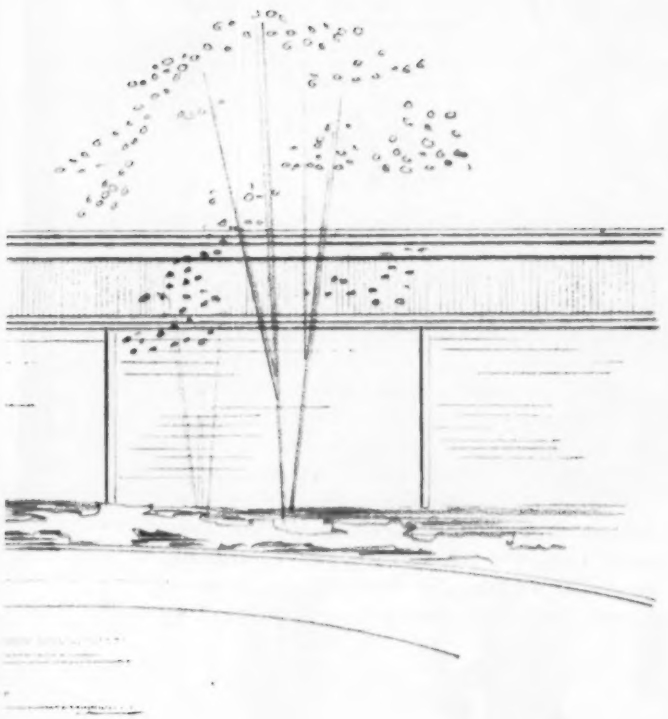
Plant and Research and Development Laboratory: Speidel Corporation, Industrial Division, Warwick, Rhode Island
Engineers and General Contractors: Bowerman Brothers, Providence, Rhode Island

$4,000 FOR ADDITIONAL INSULATION WILL BRING THESE ESTIMATED SAVINGS:

$12,000 ON MECHANICAL EQUIPMENT—Original specifications called for one-inch fiberboard roof insulation. A Dividend Engineering analysis forecast that increasing the thickness to one and one half inches of Fiberglas† Roof Insulation would produce optimum heat savings. The added efficiency made it possible to predict a $12,000 saving on the cooling equipment alone.

$1,800 PREDICTED SAVING IN ANNUAL OPERATING COSTS—$784 on power and water; $700 on financing; $316 on depreciation and insurance. Without a Dividend Engineering evaluation to point out the optimum "thermo-economic" performance of the roof, $1,800 would be wasted every year.

Let us show you how Dividend Engineering forecasts significant savings, and makes the comfort benefits of year-round air conditioning an economic possibility for more and more industrial and commercial structures. Just talk to your Fiberglas representative, or write: Owens-Corning Fiberglas Corporation, Industrial and Commercial Div., 717 Fifth Avenue, New York 22, N.Y.



DIVIDEND ENGINEERING
DOLLAR-SAVING PROPOSAL

Cost of Heating & Cooling Equipment	
Original Specifications	$32,000
Dividend Engineering Specifications	20,000
Predicted Saving	$12,000
Additional Insulation Cost (in place)	4,000
Net Initial Saving	$ 8,000
Projected Annual Operating Costs	
Original Specifications	$ 9,947
Dividend Engineering Specifications	8,147
Annual Saving	$ 1,800

OWENS-CORNING RESEARCH pioneers new ideas in Fiberglas

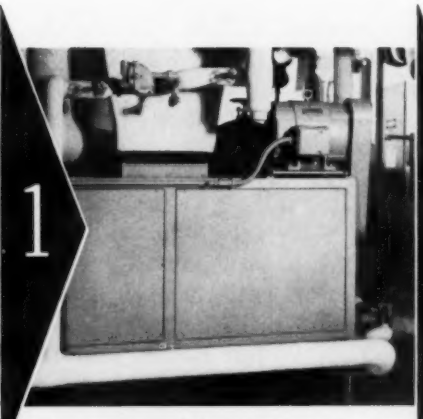
OWENS-CORNING
FIBERGLAS

†T.M. (REG. U.S. PAT. OFF.) O-C. F. CORP.

AAF keeps white-room

3-step air cleaning system utilizes three different types of AAF filters

STEP 1. AIR COMING INTO C. P. CLARE OFFICE AND PLANT is cleaned by completely automatic AAF Electro-Matic electronic precipitators.



STEP 2. INTAKE AIR FOR AAF Kennard/Nelson AIR CONDITIONING UNIT serving white room is further cleaned by AAF Electro-PL filters which combine the principles of electronic and dry-type filtration.

STEP 3. AIR ACTUALLY ENTERING WHITE ROOM is filtered by AAF high-efficiency Type F filters enclosed in the duct running from the outlet of the air conditioning unit to the white room.

White room operations involving the assembly of electrical relays demand ultra-clean air and rigidly controlled temperature and humidity. The planners of the new addition at C. P. Clare Co., Chicago, determined that their white room should have a complete air system all its own. Logically, they turned to AAF.

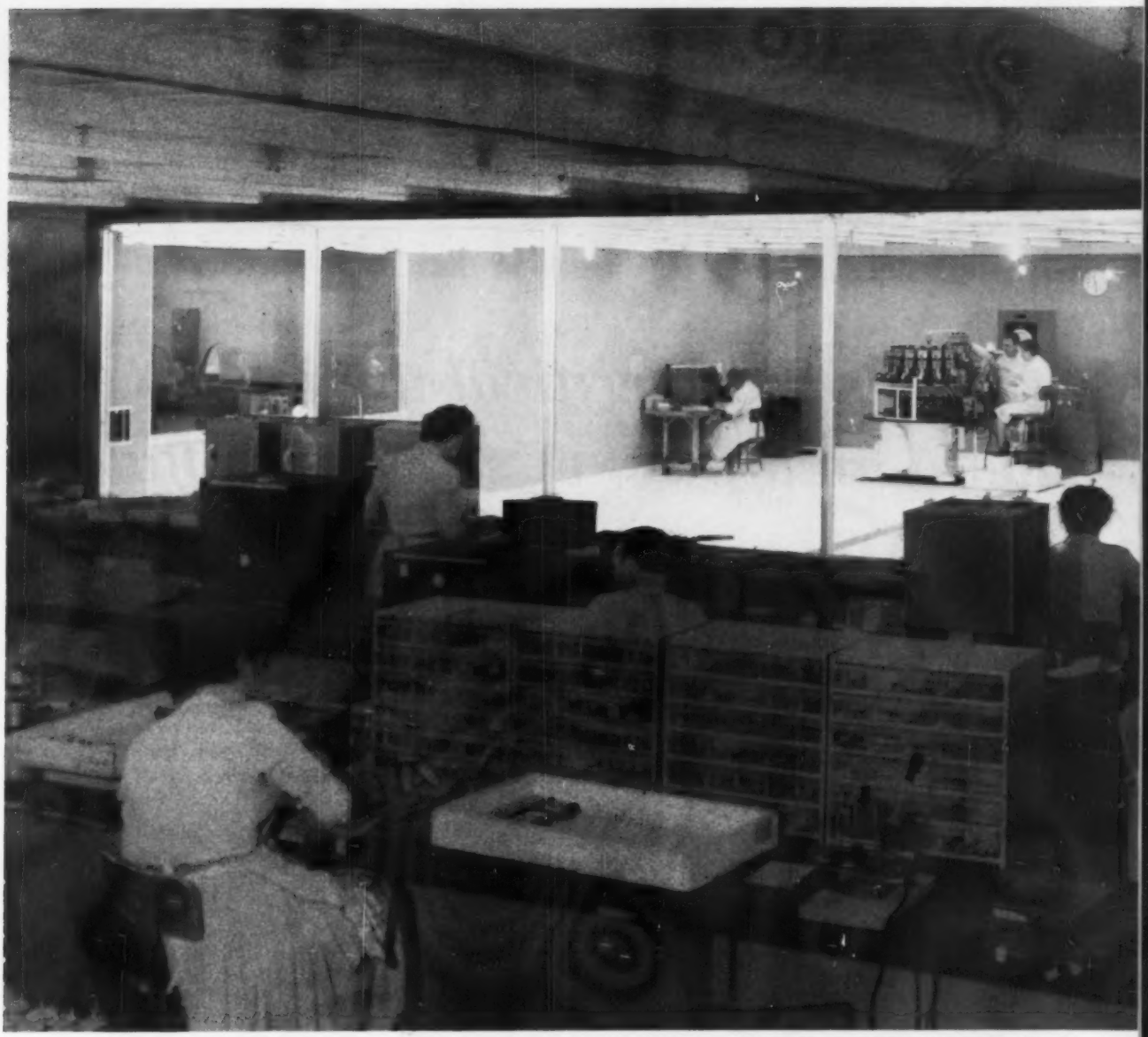
AAF provided one type of electronic filter for cleaning the air ventilating the office and plant. Another type of electronic filter cleaned this same air again before it entered the high-pressure air conditioning unit (AAF Kennard/Nelson) that controlled temperature and humidity for the white room. Still a third type of AAF filter—this one the most efficient of the three—was installed in the duct leading from the air conditioning unit to the white room itself. Result: white-room air to white-room standards—99.97% dust-free, constant 72° temperature, and controlled humidity.

This white room system points up AAF's capacity for clean-air engineering. Only AAF makes *all kinds* of filters. Thus, AAF can always fit the right filter (or combination of filters) to the needs of the specific air-cleaning job. For information on all the AAF products in operation at the Clare plant, call your local AAF representative or write us direct. Address: Robert Moore, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Kentucky. In Canada: American Air Filter of Canada, Ltd., 400 Stinson Blvd., Montreal 9, P. Q.

AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

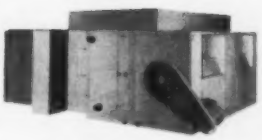
air *white-room clean!*



Architects: Rapp & Rapp, Chicago.

AAF Electro-Matic
Electronic Precipitator
Bulletin 250

AAF Electro-PL
Electronic Dry-Type Filter
Bulletin 257

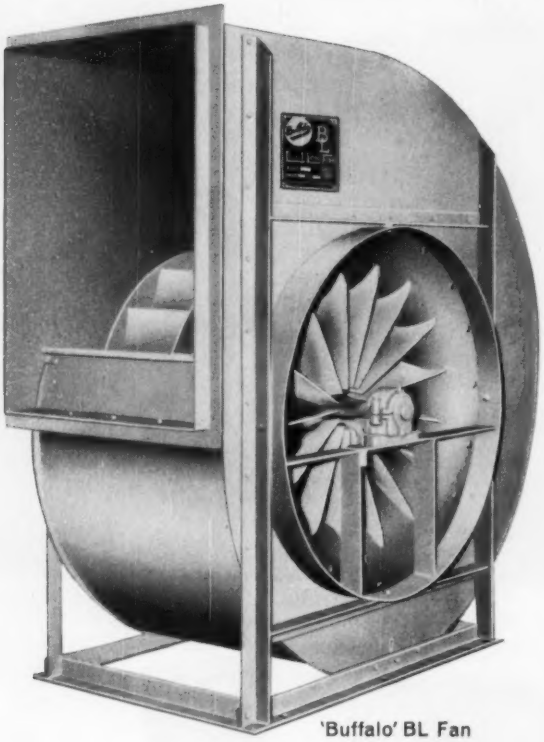


Kennard/Nelson
Air Conditioning Unit
Bulletin AC 100

AAF Type F
High-Efficiency Filter
Bulletin 238

QUALITY CONSTRUCTION? OF COURSE IT PAYS! Whether you sell it or buy it, there is no worthwhile substitute for quality construction. Where quality is high . . . performance and reliability are high. Where quality is sacrificed . . . maintenance and repair costs rise . . . customer satisfaction drops. For 84 years, Buffalo Forge has specialized in quality air and liquid handling equipment. It has paid off for the men who specify 'Buffalo'. Of equal importance, 'Buffalo' users are enjoying the true economies that only quality construction can produce.

the more critical the job . . . the more it pays to specify 'Buffalo'



'Buffalo' BL Fan

On critical jobs involving air and liquid handling, it is costly to compromise on equipment quality. Performance suffers. Downtime increases. Service life of the unit and working parts is shortened. Buffalo Forge engineering representatives, backed by a home office team of research and production engineers, will be glad to help you recommend and specify the *correct* equipment. Simply contact our representative in your area. Or, write to our home office direct.

THE WHEEL'S THE THING!

The 'Buffalo' BL Fan with its exclusive non-overloading backward-curved bladed wheel has earned a reputation for quiet, efficient, stable operation. This fan is being used to perfection on practically every conceivable job requiring Class I or II construction. Stationary inlet vanes are standard. Correct design permits use of optional variable inlet vanes rating. Design at inlet and outlet permits easy, air-tight connection of ductwork. Capacities range from 600 cfm to 500,000 cfm. For complete performance and construction details, write for Bulletin F-104.

"Buffalo"

AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

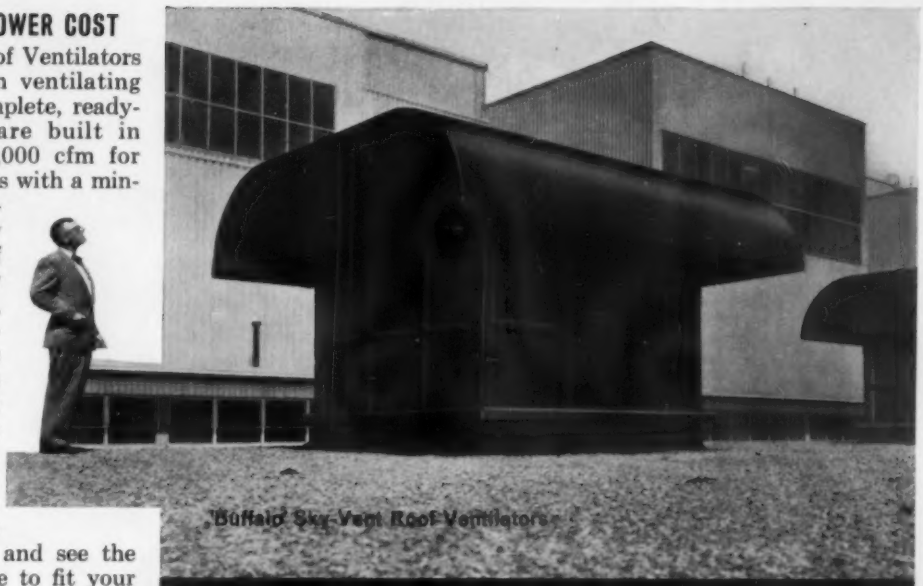
'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

HIGH CAPACITY FOR LOWER COST

'Buffalo' Sky-Vent Roof Ventilators offer many savings in ventilating large areas. These complete, ready-to-install packages are built in capacities up to 250,000 cfm for economical installations with a minimum of units. Thousands of these ruggedly built, weather-proof units are dependably exhausting fumes, mists, stale or overheated air from process and production areas . . . with no duct-work to alter when a plant layout is changed. Also built with filters and for heating coils as makeup air units. Write for Bulletin FM-2345 and see the wide selection available to fit your exact job requirements!



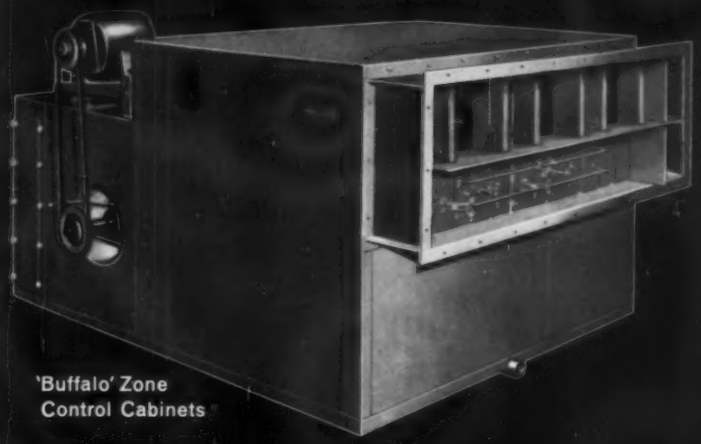
'Buffalo' Sky-Vent Roof Ventilators

ACCURATE MULTI-ZONE CONTROL

'Buffalo' Type PCB Zone Control Cabinets deliver the exact degree of comfort desired, zone by zone, through precise damper control. Dampers are heavy-gauge, with blades of die-formed shape for rigidity and tightness of fit. All zone openings are factory-sized for proper distribution.

Another exclusive feature is the 'Buffalo' mixed-flow type aluminum-wheel fan. Its steep pressure characteristic means minimum variation in capacity and power. Operation is fully stable, without pulsation or hunting. For ease of maintenance, fan bearings are outside lubricated.

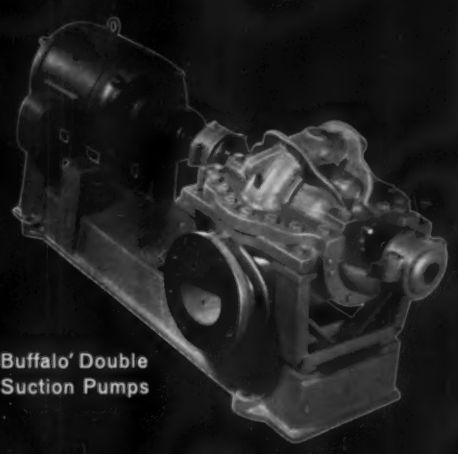
Here is a unit that is made-to-order for many of your office building jobs. Full details, including construction, dimensional and performance data, are in Bulletin AC-220. Write for your copy.



'Buffalo' Zone Control Cabinets

THE LATEST IN PUMPING EFFICIENCY!

'Buffalo' Double Suction Pumps have earned their reputation for smooth, efficient handling of clear water over many years. Now, the new-design 'Buffalo' Double Suction Pumps incorporate their best features plus many new ones . . . for the finest performances yet available. Suitable for working pressures up to 250 psi and temperatures up to 300° F., these new pumps are available in capacities from 20 to 14,000 gpm. Write for details on this and other new developments in efficient, dependable pumping by 'Buffalo'.



'Buffalo' Double Suction Pumps

PPG Fiber Glass Pipe Insulation is quickly installed, provides top thermal insulation at Fontainbleau Towers addition in Miami Beach. 100,000 ft of this insulation was used, as well as PPG Duct Liner and Duct Insulation.

"We chose PPG Fiber Glass Insulation Materials because they are easier to handle than any other insulation products"

. . . says Mr. Joseph Crabtree, President, Crabtree Insulation Company, Miami, Florida

Crabtree Insulation Company had the contract to install all pipe and ductwork insulation in the new 405-room addition to Fontainbleau Towers, Miami Beach. Choice of materials was given to the company.

Mr. Crabtree asked his superintendent what materials he felt should be used, and was advised that the men preferred PPG Fiber Glass Insulation Products because they were easier to handle.

As a result, Crabtree Insulation Company used 100,000 ft of PPG Pipe Insulation, 25,000 ft of PPG Neoprene-coated Duct Liner, and 25,000 ft of PPG Duct Insulation in the new Fontainbleau Towers addition.

Mr. Crabtree reports the insulation job went faster and with fewer problems than if other materials had been used. On the basis of this job and other jobs where he had used PPG materials, he would recommend PPG with no hesitation to other contractors.

WANT TOP RESULTS? TRY PPG!

PPG has a wide range of fiber glass thermal and acoustical insulation products that speed installation, provide excellent insulating properties, give long service life with little or no maintenance. If you haven't tried them, get full information by contacting your nearest PPG Fiber Glass Sales Office, or by writing *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

FIBER PPG GLASS

PITTSBURGH PLATE GLASS COMPANY

Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Kansas City, Louisville, Los Angeles, Miami, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and Seattle.

you'll want to know...

Mechanical Contractors Association Elects New Officers at Miami Convention

THE NEW PRESIDENT of the Mechanical Contractors Association of America is Frank V. McBride of Paterson, N.J. He was elected at the 72nd annual convention of the MCAA in Miami Beach, Fla. last month along with other association officers and directors.

Leon L. Munier, New York, N.Y., is the senior vice president. The treasurer is Arthur R. Nagel, Cincinnati, Ohio. Board of director members elected are as follows: James H. McCauley, Jr., Chicago, to complete the unexpired term of Joseph H. Kearney, immediate past president of the association; W. H. Singleton, Washington, D.C.; Fred Williams, Boston; James M. Anderson, Jr., Philadelphia; Anthony L. Cherne, Minneapolis; George N. Rieke, Green Bay, Wis.; and John A. Rice, Charlotte, N.C.

Close to 700 members and guests attended the convention where both management and technical problems were discussed in panel groups and general sessions. A panel discussion on the subject of what causes coil freeze-ups was held, and a full report will be presented next month in Heating, Piping & Air Conditioning. A panel discussion on pipe welding was held also and will be featured in a future issue.

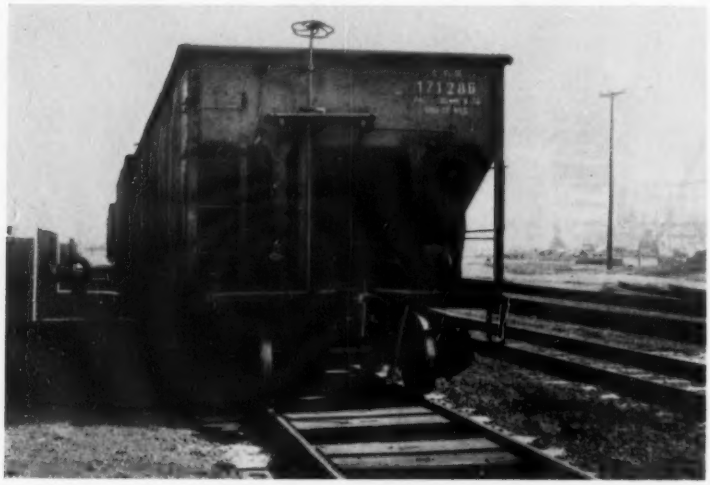
A. L. Cherne presented the an-

MCAA new officers: Arthur Nagel, treasurer; Leon Munier, senior vice president; Frank McBride, president; Joseph Kearney, past president

you'll want to know

nual statistical survey of operating costs and ratios of the various segments of the business by members. He was the committee's chairman. It was reported that average overhead for operations in 1960 had been reduced as compared with 1959.

MCAA presented its Distinguished Service Award for 1961 to Grant Joseph Hayes, Indianapolis. The award was given for "outstanding service to the industry and in sincere appreciation of his many years of unselfish and valued work." He has served as chairman and a member of the Committee on Apprenticeship of the MCAA since 1949, and as chairman and a member of the National Joint Pipefitter Apprenticeship Committee of the Plumbing and Pipefitting industry since its inception in 1956. Mr. Hayes has also served as a member of the Board of Trustees of the National Certified Pipe Welding Bureau since 1956.



Remote Control Thawing Station Enables Utility To Thaw Up To 10 Train Cars an Hour

A ONE-MAN thawing station in Baltimore allows a local gas and electric company to thaw up to 10 train cars an hour. The 225 ft facility handles five cars at a time.

Thirty-six prefabricated thawing pits are arranged so that any size car, or any combination of sizes in a five-car train, can be thawed effectively without damaging the cars. Each pit radiates heat at the rate of 1.5 million Btu per hr. The arrangement of pits makes available to each car as much as 6 million Btu per hr.

The thawing facility is operated from three remote control panels, which are mounted on a windbreak. The windbreak is located about 30 ft from the track.

The first step in a thawing operation is manually igniting all pilots. Then the operator pushes buttons to start up individual units, according to the Hauck Manufacturing Co.

Each of the 36 pits contains two oil-fired burners, a pilot, and safety equipment. Air needed for oil atomization and combustion is provided by low-pressure air blowers. The pits have hinged, split covers that remained closed when not in operation. The burners and controls are protected by individual covers.

Public Health Official Calls for More Attention On Air Pollution Control

A CALL for more action to strengthen the Federal air pollution program has been made by V. G. MacKenzie, chief, Division of Air Pollution, U.S. Public Health Service. Mr. MacKenzie said that there is a definite need to establish three essential elements to combat the problem: first, an expanded research program related to the causes, effects, and control of air pollution; second, Federal assistance to states and localities in the development and support of programs designed to apply more effectively the knowledge we now have and will have in the future to the control of air pollution; and third, vigorous leadership in obtaining increased attention and the devotion of greater resources to the problems of air pollution control by all levels of society.

Although Federal leadership and assistance is of significance in the total effort, the prime necessity is for greater control activity by state and local government organizations who have the basic legal responsibility for air pollution control, according to Mr. MacKenzie.

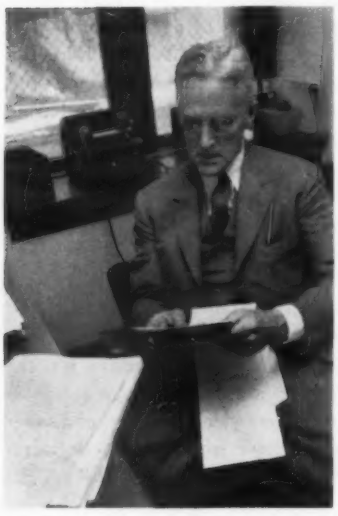
Copies of the 1960 edition of "A Digest of State Air Pollution Laws" published by the U.S. Department of Health, Education, and Welfare, Public Health Service, may be obtained by writing to the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. The price is 75 cents.

Check-Out For A Warm Ride

How DOES an astronaut "keep cool" in a space capsule that has an outside temperature of 2000 F? This will be the situation when the United States orbits the first American in Space.

The space capsule will be the same type that carried Commander Alan B. Shepard into space and fame last month. Specific temperatures on the spacecraft will vary at different locations from a possible high of 2000 F during the most severe uncontrolled re-entry to a low of −100 F during orbit.

A highly efficient heat shield will absorb only a small portion of the heat energy created during re-entry. Insulation will be used to isolate the occupant and equipment from the extreme temperatures, according to the Johns-Manville Corp. In addition, an evaporative cooling system will pump cool oxygen through the astronaut's spacesuit, keeping him relatively comfortable during his re-entry maneuver when cabin temperatures may reach a maximum high point of 170 F.



Presents Tribute to Professor Philip Drinker, HPAC Consulting Editor

AN EDITORIAL tribute has been paid to Professor Philip Drinker by the magazine *Archives of Environmental Health* for his "enduring contributions to the development of the health sciences to meet the challenge of problems resulting from the industrialization of our society."

A member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, Professor Drinker (shown at left) is well known in the field of industrial hygiene. His role as editor of the *Journal of Industrial Hygiene and Toxicology*, the forebear of the Archives, was singled out as his major contribution in this field.

Houston Bank Has 3600 Ton Gas Air Conditioning System

PATRONS of the new First City National Bank of Houston, Texas will be kept in cool comfort due to the installation of a 3600 ton gas air conditioning system. The cooling and heating plant is located at

you'll want to know

the top of the 32 story structure.

Each office space has individual thermostats which automatically assure the most desirable temperature and humidity by controlling the flow of chilled or hot water through the coils. Three centrifugal compressors in the system are driven by three 1200 hp steam turbines. Steam for the turbines is supplied by three boilers, two of which have capacities of 35,000 lb of steam per hr each and the third with a capacity of 18,000 lb of steam per hr.

Proposes Snow Melting Equipment for Sidewalks In Philadelphia

A PROPOSAL that all sidewalks in Philadelphia's future construction have radiant heating systems for the purpose of snow and ice removal has been made by the city's Street Commissioner, David M. Smallwood.

In a letter to Philadelphia's Development Coordinator, William L. Rafsky, Mr. Smallwood cited the success of such a system now in use at the Philadelphia National Bank. He stated that the initial cost would be nominal as compared to the ultimate benefits derived in dealing with the city's snow problem.

U.S. Army Builds Temperature Chamber To Test Weapons in Severe Weather Conditions

NO LONGER will it be necessary for the U.S. Army to transport weapons to remote sections of the world in order to test them under severe weather conditions. An extreme temperature chamber for this purpose has been built at the Watervliet Arsenal in New York by the U.S. Army Ordnance Corps.

Before this facility was built, weapons had to be shipped to various areas in the world where hot or cold temperatures existed naturally. Now this won't be necessary, according to John C. Kacharian, Chief, Engineering Section, Watervliet Arsenal.

Weapons are mounted on a stand in the room and allowed to reach the temperature desired. At present, temperatures as low as −65 F can be reached, with 200 F being planned for the upper limit. The weapons are then fired, using a blank charge to produce the equivalent reaction of live ammunition. Results are recorded and engineering changes made, if necessary. Guns tested range in size from 30 to 175 mm. Missile components are given various tests in the chamber, also.

The chamber area is a 14 × 27 × 11 ft high room with walls of 12 in. brick. A vapor barrier is applied to walls, roof, and floor. Electric cables in the concrete subfloor prevent penetration of frost.

Cooling is supplied by two 30 hp compressors, each producing 4.5 tons at −80 F suction temperature and 97 F dry bulb ambient. They are provided with automatic capacity controls for year around operation. Refrigerant 13 is used in one compressor and Refrigerant 22 for the other, the charge being 55 lb of Refrigerant 13 and 110 lb of Refrigerant 22. Liquid strainers and compressor-scale traps collect scale and dirt and may be cleaned without breaking the pipeline connections or opening the compressors; dehydrators are also a part of the system.

A 3 hp unit cooler containing fans, evaporator surfaces, and heat exchangers is located within the chamber. Control for the cooler is furnished by a temperature recorder-controller and solenoid valve in the liquid Refrigerant 13 line; the Refrigerant 13

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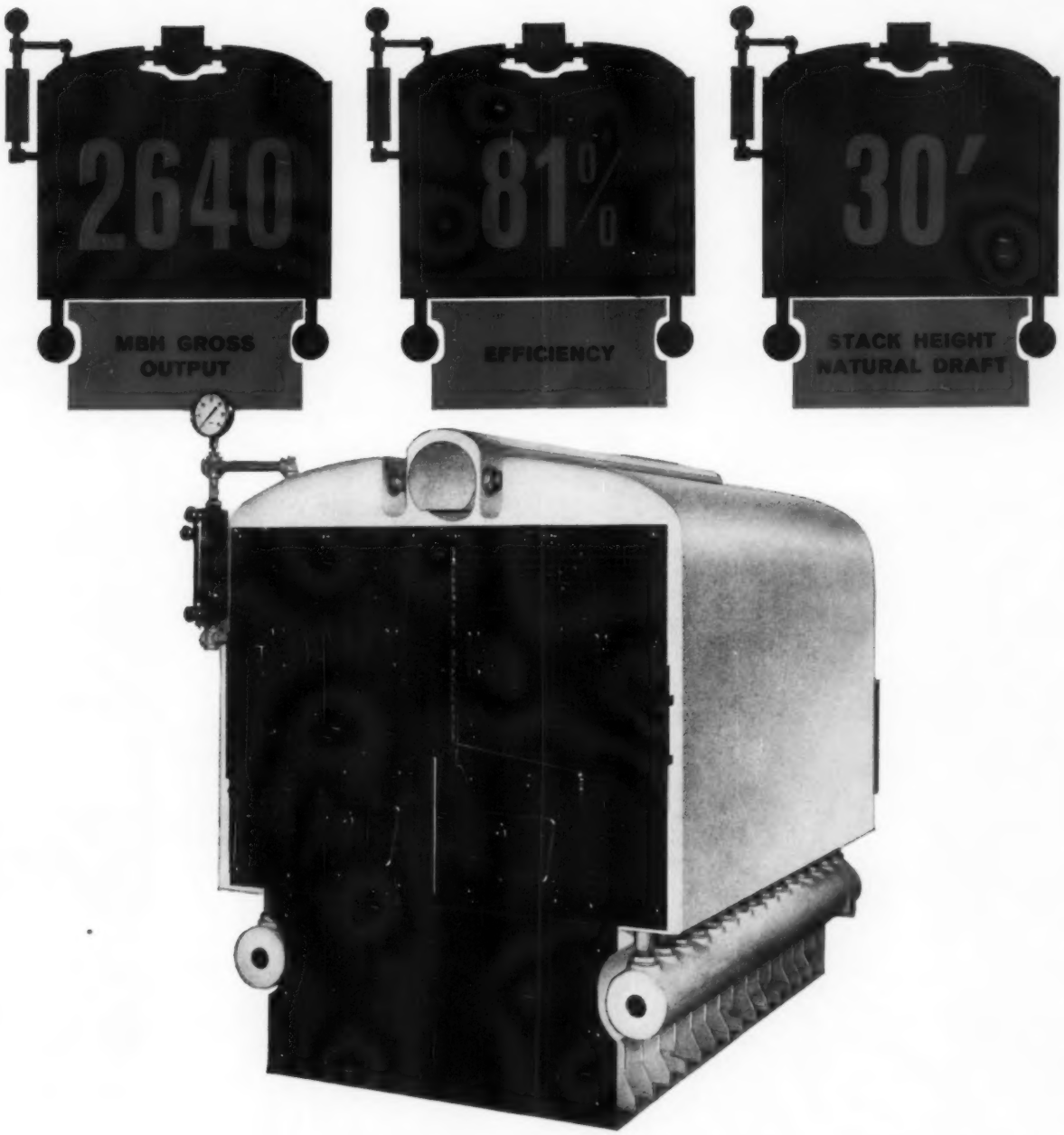


Mills '450'

Yes, that's what a 13-section '450' Mills boiler will do. Compare the necessary chimney height with *any other* boiler of its size—cast iron or steel—and see what savings can be achieved by specifying a *LOW DRAFT LOSS* H. B. Smith '450'.

Other sizes of this remarkable new boiler range from 1584 MBH to 4120 MBH output with chimney heights from 25 to 37 feet.

H.B. Smith CAST IRON BOILERS

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • Established 1853

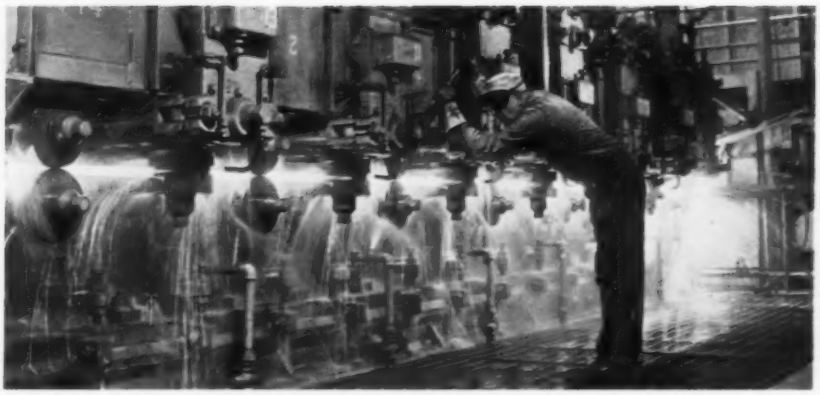
THE NEW CHRYSLER STAMPING PLANT

In the boiler house of this stamping plant operation at Twinsburg, Ohio, there are more than 1800 tons of J&L Jal-Con-Weld pipe carrying steam, water and air through the 34-acre plant.

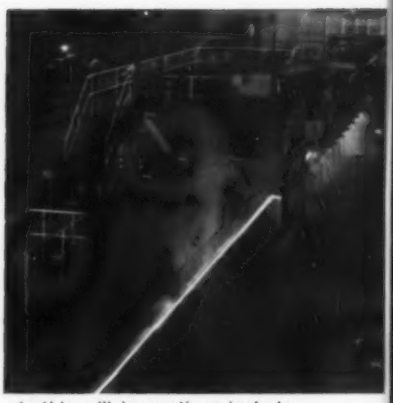
These coal-fired boilers supply 150,000 pounds of steam per hour under 150 psi through Jal-Con-Weld pipe.

Four air compressors deliver up to 30 million cubic feet of air per day at a pressure of 100 psi through Jal-Con-Weld pipe to air tools on the 28 major press lines, plus tool room and assembly areas.

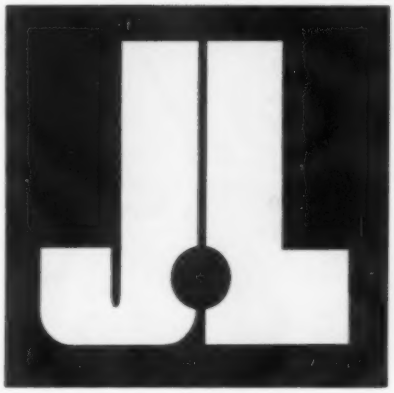
Three 2500-gallon-per-minute pumps keep cooling water circulating through Jal-Con-Weld pipe to scores of spot welding units in the assembly lines.

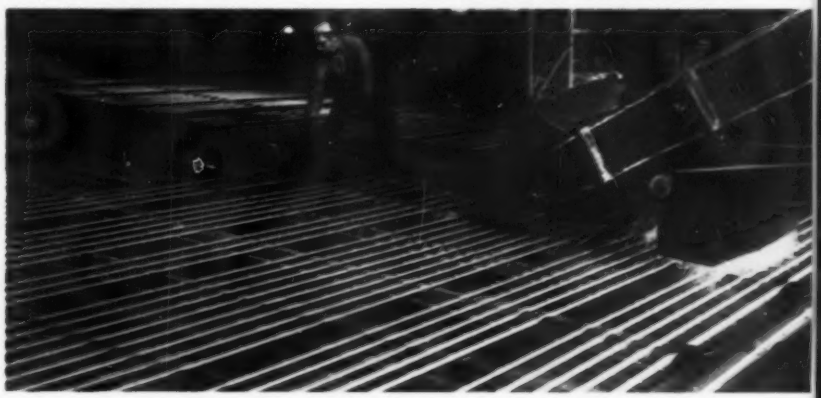


A continuous strip of skelp, heated to a welding temperature of approximately 2450°, passes rapidly through the forming rolls where it is shaped into cylindrical form.



In this mill, inspections include hydrostatic testing on each line in two modern Schloemann testers.





Finishing operations include cutting to proper length, straightening, facing, threading and hot dip galvanizing.

"Jal-Con-Weld pipe guarantees trouble-free installation and performance"

. . . says president of The Stanley-Carter Company

Over 1800 tons of Jal-Con-Weld pipe were installed by The Stanley-Carter Company in this new Chrysler stamping plant in Twinsburg, Ohio.

"J&L pipe is uniformly round, straight and easy to work," said Mr. Stanley Carter. "And, we like the service available through J&L and its distributors."

The distributor who handled this job was H. J. Rothwell Fitting Company, Canal Fulton, Ohio.

Jal-Con-Weld pipe is produced on two of the most modern continuous weld pipe mills in the world. These mills were installed by J&L at a cost of $18,000,000, and incorporate the most advanced equipment to produce high quality standard pipe in sizes which range from one-half inch to four inches.

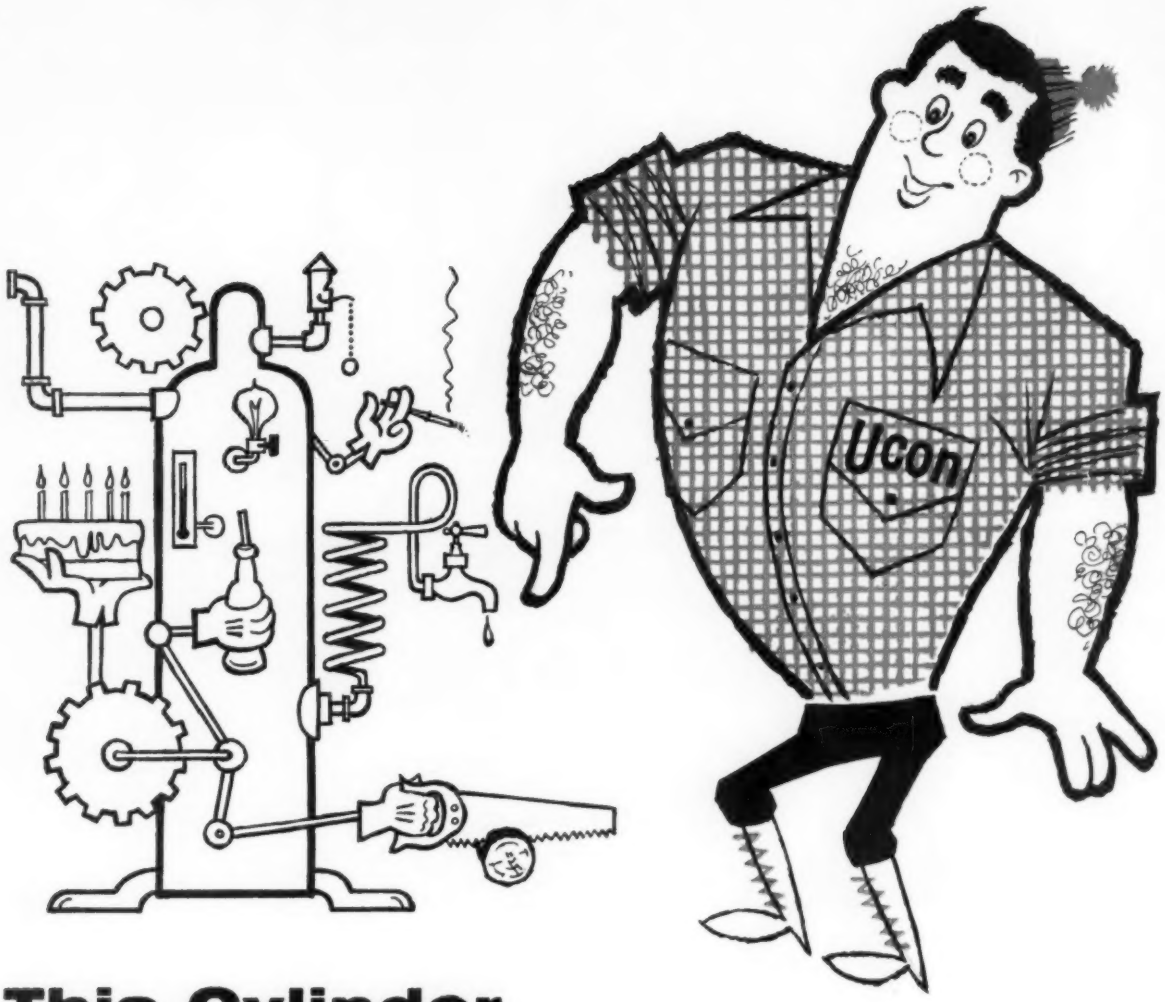
The continuous weld process utilizes skelp in coil form. Weld is formed by pressure rolls, under ideal temperature conditions. Before skelp enters the welding pass, a jet of air is blown on the edge to remove scale and increase temperature for a stronger weld.

It will pay you to standardize on controlled-quality Jal-Con-Weld pipe.

Call your nearby J&L distributor, or for more information, write for J&L's new bulletin, "Jal-Con-Weld," Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA



This Cylinder Does Everything...

... stands right side up, upside down, discharges top, bottom and middle, carries itself, heats soup, grinds nuts, and transports you to and from the customer via a detachable propulsion system. Available in 27 sizes, it's the perfect answer to your every oddball requirement.

But for every day THESE THREE WILL SUFFICE...

Make no mistake about it—by SUFFICE, we mean cover the ball park. In one ... two ... *three* UCON® Refrigerant Cylinders you'll find every important packaging convenience, every cylinder size you need, *and*—you can always be sure your wholesaler will have what you need, *when you need it*. Helpful technical assistance, too, is yours for the asking with UCON Refrigerants. Conclusion:

For the most compact and convenient line of refrigerants—
See Your UCON *Refrigerants Wholesaler*

UNION CARBIDE product **Ucon®** refrigerants — exclusive sales agent **ANSUL**

UCON Refrigerants are manufactured by
UNION CARBIDE CHEMICALS COMPANY— Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

Exclusive Sales Agent to Air Conditioning and Refrigeration Wholesalers
ANSUL CHEMICAL COMPANY, Marinette, Wisconsin

UCON and UNION CARBIDE are registered trade marks of Union Carbide Corporation

Announcing the newest addition to the Amprobe family

NOW TEST VOLTS AMPS AND OHMS

FOR ONLY $29.85

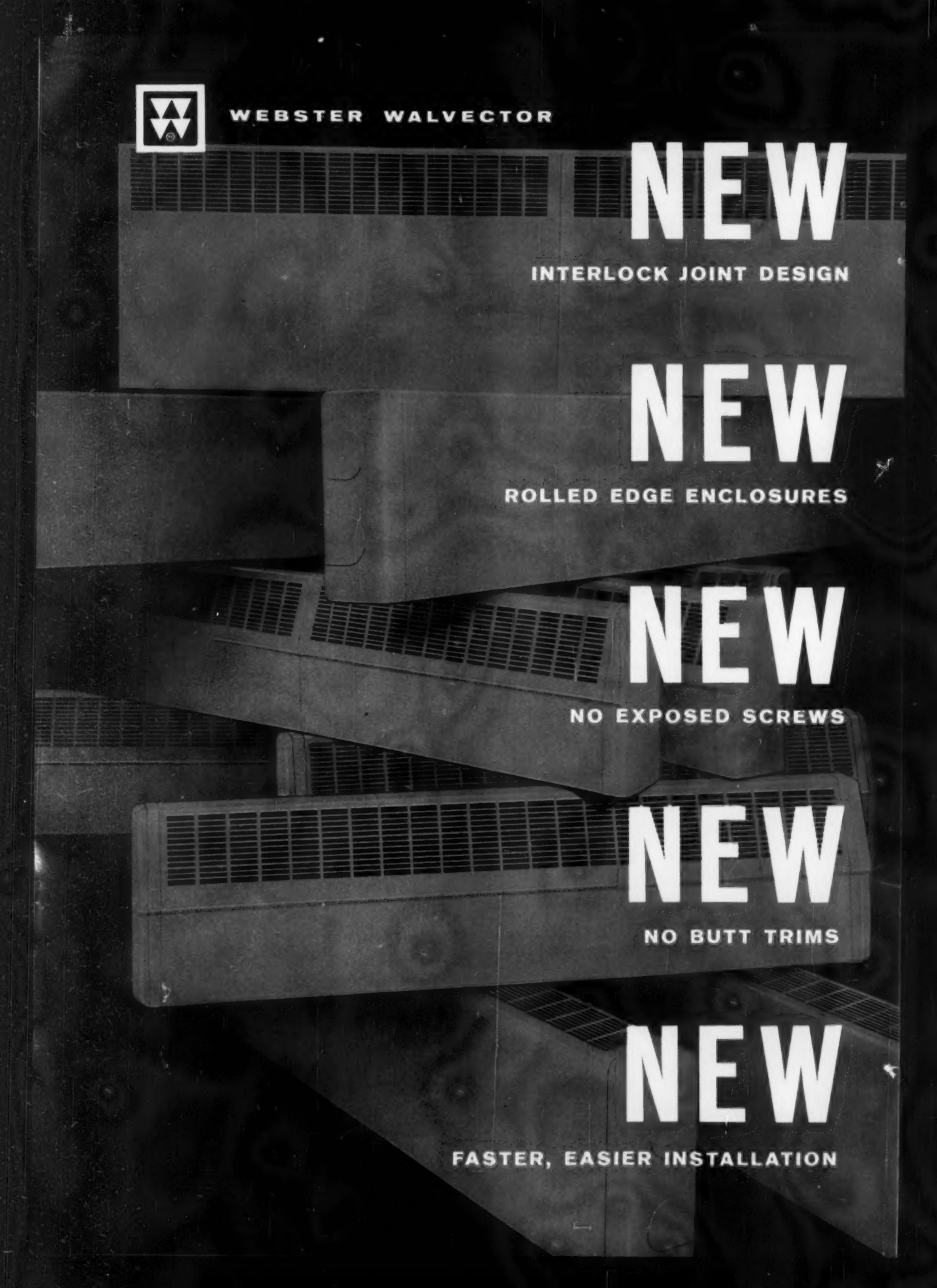
You read right. The AMPROBE JR. *Testmaster Kit* lets you *read* voltage on a calibrated scale (not just an indication), measure amps *without* interrupting service *and* test for resistance...at half the price you'd expect to pay for a tool of similar versatility

The Kit consists of the AMPROBE JR., an ohmmeter attachment, test leads, a leather carrying case and the AMPROBE *Energizer* ("splits" double-conductor cords for direct readings at outlets, or boosts the sensitivity of the instrument 10X for readings on fractional h.p. motors).

Pick the range that best fits your job from six rugged, lightweight models: 0-25 to 0-100 amp; either 0-125/150 or 0-150/600 volts AC; 25 ohms mid-scale. For more details about this newest addition to the most-complete family of pocket-sized, snap-around test instruments in the world, see your Distributor or write for Catalog sheet AAD-1.

PYRAMID INSTRUMENT CORP., LYNBROOK, N. Y.

Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto


WEBSTER WALVECTOR
NEW
INTERLOCK JOINT DESIGN
NEW
ROLLED EDGE ENCLOSURES
NEW
NO EXPOSED SCREWS
NEW
NO BUTT TRIMS
NEW
FASTER, EASIER INSTALLATION

ONLY NEW **WEBSTER WALVECTOR** OFFERS ADVANCED FEATURES IN A COMPLETE LINE OF FIN TUBE RADIATION

Start with the handsome Walvector enclosure. Note the trim look where one length of enclosure joins another. There's no butt trim to install with new Webster Walvector—no unsightly screws required to fasten the joint. New Webster Walvector has *interlock joint*. Sturdy interlock channel welded to the right end of each enclosure interlocks with the rolled *left* edge of the next. Butt trims and metal screws—and the time and labor that goes with them—are eliminated. New Walvector enclosures are rugged *18 gauge steel* with rolled edges at both ends—connect quickly, easily, *securely* to produce an unobtrusively attractive joint structurally reinforced by the interlock channel itself. Interlock Joint is *standard* on all Webster Walvector fin tube radiation . . . enclosures *and* a complete line of trim pieces. End caps, inside and outside corner pieces, access door sections, column enclosures—all are designed with rolled edges and interlock joint to assure clean-line installation for every layout requirement.

FASTER, EASIER INSTALLATION

SEAT ON TOP CHANNEL

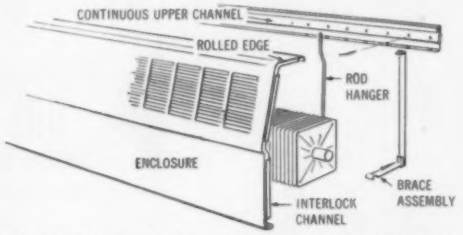
MATE INTERLOCK JOINTS

SNAP INTO POSITION

LOCK AT BOTTOM

What's *inside* the enclosure? More new design and construction features to speed and simplify installation of the most efficient Tru-Perimeter radiation for steam or hot water heating systems. Continuous rolled upper support channel on new Webster Walvector, for example, eliminates the need of special gussets for hanging dampers or holding heating element hangers.

Newly designed rod hangers fasten to the upper channel with a friction-type clip which permits easy height adjustment of the heating element. The brace assembly requires fastening to the channel at only one point



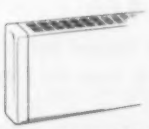
. . . fastens to the lower edge of the enclosure with a sure cam-lock-action. Installation of all Walvector components can be readily handled by one man. Nonferrous copper tube and aluminum fin heating element is used in new Webster Walvector. It is light in weight and easy to handle, basic to Webster Tru-Perimeter Heating.

NEW—inside *and* out! Yet hidden features remain unchanged in Webster Walvector. The quality of manufacture and long-service life inherent in Webster products for the past 75 years continues to be your further assurance of reliable, effective comfort heating wherever you install new Webster Walvector. A Warren Webster representative will welcome the opportunity to discuss the advantages of *Webster* Walvector for your application.

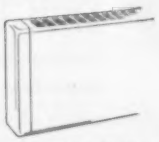
NEW: Special packaging saves installation time . . . prevents marring of enclosures.

All "roughing-in" material shipped in advance. Enclosures shipped as required.

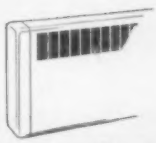
SLOPE TOP ENCLOSURE



FLAT TOP ENCLOSURE



DELUXE FLAT TOP



CUSTOM WALVECTOR

WARREN WEBSTER & COMPANY, INC.

CAMDEN 5, NEW JERSEY

HENRY VALVE CO.

CONTROLLING FLOW SINCE 1914

DEMAND IS GREAT... EVERYONE IS BUYING THESE EXTRA VALUE PRODUCTS

"DRI-VUE" Moisture-Liquid Indicators

"DRI-COR" Filter-Driers Molded Core

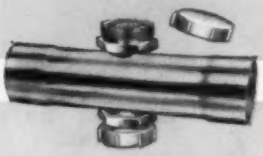
"GOLDEN BANTAM" Diaphragm Packless Valves

"DRI-VUE" INDICATOR PORT

Actually Spells "WET" or "DRY" with element Color Variation—Largest Visible Element Area.

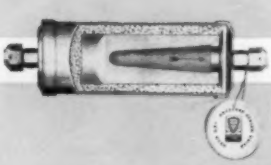
"DRI-VUE" INDICATORS

Double Port Moisture-Liquid Indicators, Large O.D.S. Sizes. Triple Sealed Ports.



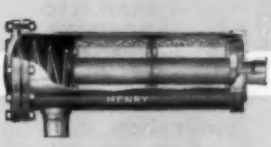
"DRI-COR" FILTER-DRIERS

Two Stage Drying; Molded Core and Granular Desiccant. Abso-dry Processed.



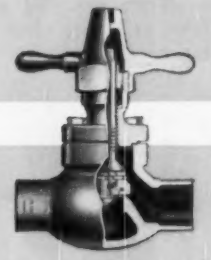
"DRI-COR" Cartridge DRIERS

Molded Filter Core and Granular Desiccant. Split Second Cartridge Installation.



SHUT-OFF VALVES

Packless and Packed with Flanged and Integral Connections. Wide Range of Sizes and Types.



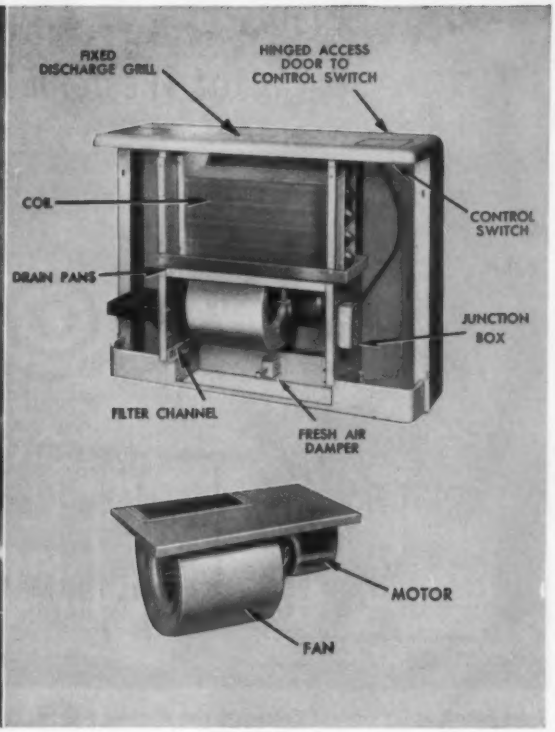
Only Henry offers you this complete variety of types and sizes, from ¼" flare packless to 4⅛" O.D.S. packed Wing Cap valves, from 1 ton sealed type to 165 ton cartridge type filter-driers and ¼" flare single port to 2⅛" O.D.S. double port moisture indicators.

HENRY VALVE COMPANY

For Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILLINOIS, U.S.A. CABLE: HEVALCO, MELROSE PARK, ILL.

Room Comfort is Occupant Controlled



with UNIT AIR CONDITIONING SYSTEM by DUNHAM-BUSH

The Dunham-Bush unit system of air conditioning . . . with 'CR' room air conditioning units in all rooms and one central plant to handle the entire heating and cooling load . . . is ideal for any multi-room building.

Individual room control permits each occupant to select the conditions he desires—without affecting other rooms or zones. One unit handles cooling, heating and circulation of fresh, filtered air . . . quietly!

Perfectly suited for either new construction or existing buildings, the Dunham-Bush unit system requires no costly, difficult-to-install central duct system. A single piping system is utilized year 'round.

Units are available in 4 sizes from 220 to 600 CFM . . . for heating and cooling by water, direct expansion or steam; for vertical floor mounting in exposed, semi-recessed or fully recessed installation; for ceiling suspended, exposed or fully recessed installations.

Request Catalog #6014A containing complete specifications.

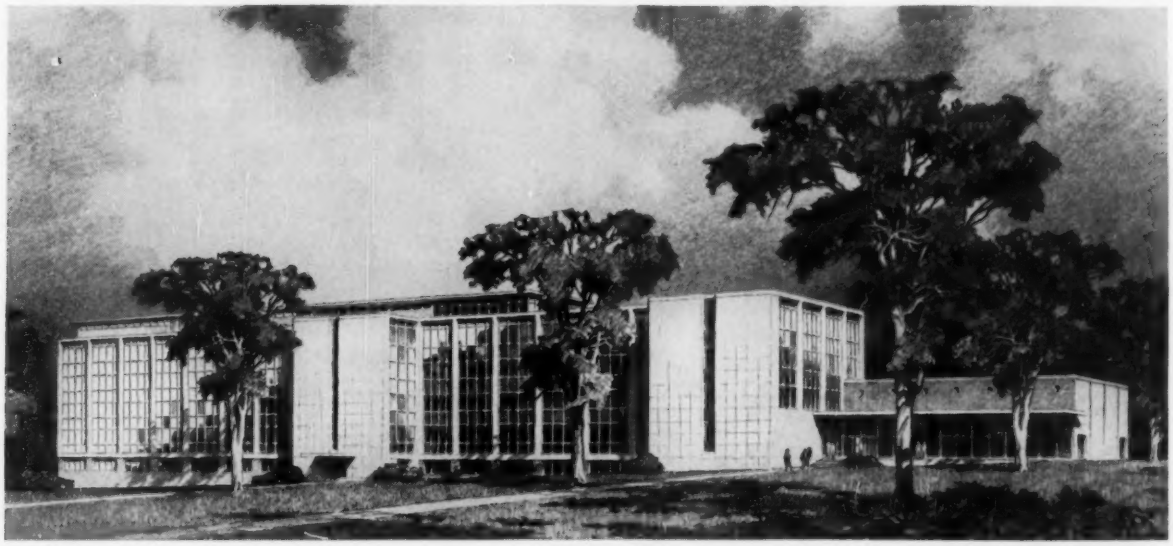
DUNHAM-BUSH

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES

In the new
Science Center
at Western Reserve University...



John Schoff Millis Science Center on the Western Reserve Campus, Adelbert Road, Cleveland, Ohio. Architects: *Small, Smith, Reeb, & Draz.* General Contractor: *The Albert M. Higley Company.* Mechanical Contractor: *Gorman-Lavelle Plumbing & Heating Company.*

105 tons of Republic Steel Pipe for waste lines, vents, heating and air conditioning piping

Good for the life of any building, steel pipe was specified for this Cleveland university science building on the basis of economy and dependability. *Republic* pipe was the choice of the Mechanical Contractor, Gorman-Lavelle Plumbing & Heating Co.

While concentrating on quality of steel and pipe-making techniques, Republic does not overlook the important details. Multiple inspection points *make sure* your pipe is free of costly and annoying imperfections.

See for yourself. Contact your Republic distributor or write Republic Steel Corporation, Department HP-2124-A, 1441 Republic Building, Cleveland 1, Ohio.

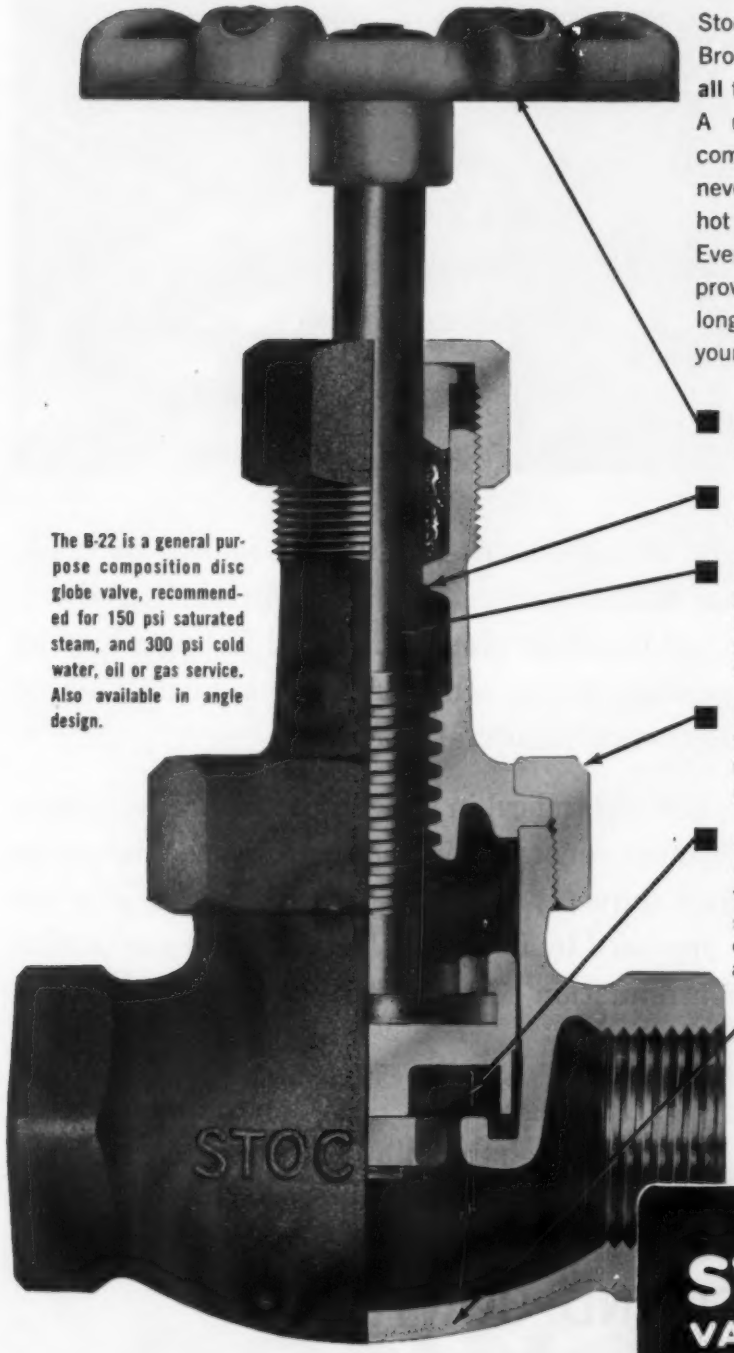
Steel
Strong
Modern
Dependable

CALL FOR REPUBLIC PIPE

...MADE AND BACKED BY AMERICANS

REPUBLIC STEEL

YOU CAN DEPEND ON IT!



The B-22 is a general purpose composition disc globe valve, recommended for 150 psi saturated steam, and 300 psi cold water, oil or gas service. Also available in angle design.

Stockham's B-22 150 lb. Composition Disc Bronze Globe Valve puts an end **once and for all** to disc misapplications and valve failures. A unique, specially-developed, all-purpose composition disc material provides positive, never-fail control for **six services**—cold water, hot water, steam, oil, gas and compressed air. Every **other** feature of the B-22 has been proved far superior to other globe valves for long, dependable, trouble-free service. See for yourself . . .

HANDWHEEL
Easy grip, non-slip, non-heating design.

REPACKING SEAT
Can be repacked under pressure when fully open.

BESTALOY STEM
Extra large diameter for added strength. Extra length stem threads give complete engagement for longer stem life. "Bestaloy" has a minimum tensile strength of 85,000 psi.

UNION BONNET
Three-piece union bonnet design allows the valve to be reassembled easily and repeatedly without injury to body-bonnet bearing surfaces.

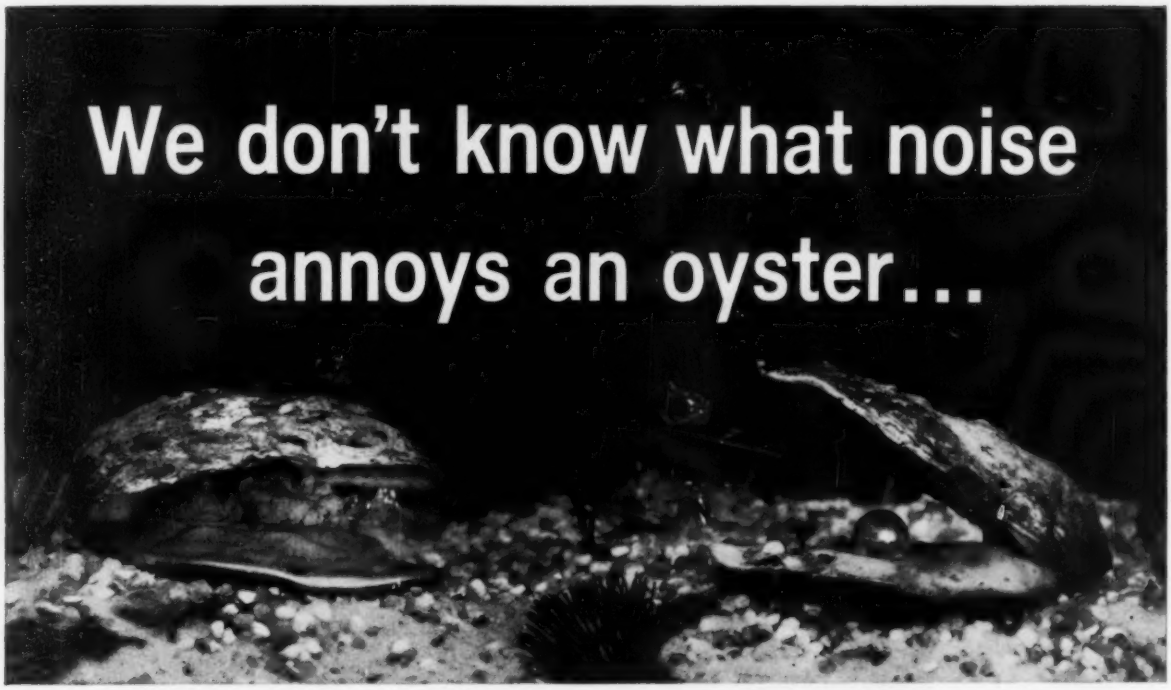
ALL PURPOSE COMPOSITION DISC
This one disc controls cold water, hot water, steam, oil, gas and compressed air. Slip-on type disc holder is guided throughout travel for perfect alignment.

HEAVY WALL SECTION BODY
Designed for minimum pressure drop. Extra heavy ribbed design gives maximum resistance to line strain.

STOCKHAM
VALVES *and* FITTINGS

STOCKED BY YOUR LOCAL STOCKHAM DISTRIBUTOR
Bronze, Cast Iron, Ductile Iron, Cast and Forged Steel Valves — Wedgeplug Non-Lubricated Plug Valves—Cast Iron, Malleable and Ductile Iron Pipe Fittings

General Offices and Plant
4000 10th Avenue, North • Birmingham, Alabama



. . . but we do know plenty about eliminating *industrial* noise. Koppers AIRCOUSTAT is the *pioneer product* for controlling duct-transmitted noise in air handling systems . . . and Koppers has the *longest, broadest experience* in the whole field of industrial sound control, from air conditioning to aircraft engines.

AIRCOUSTAT® is the quality standard in its field. Its pioneer engineering is matched by premium construction that features heavier gauge metal than competitive units. It is assembled with care to give the quality performance promised by its original design. And AIRCOUSTAT provides *guaranteed* attenuation certified in the laboratories of independent research organizations.

Write today for your copy of the Aircoustat Selection Manual, a quick guide to eliminating noise in all air-handling systems, to: KOPPERS COMPANY, INC., Sound Control Dept., 3306 Scott St., Baltimore 3, Md.

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SOUND CONTROL

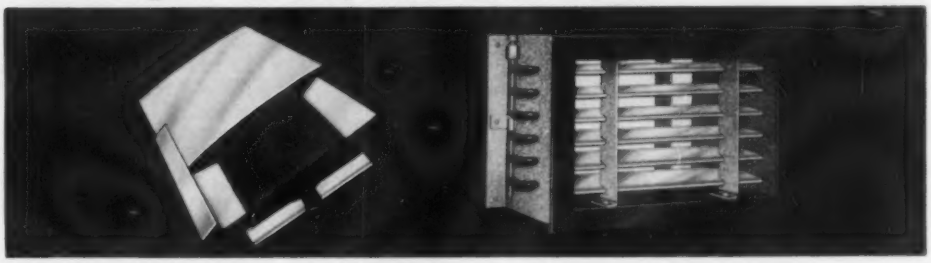
Engineered Products Sold with *Service*

Aircraft/Engine Test Enclosures | Portable Jet Run-Up Silencers | Audiometric Rooms | Soundmetal Panels

NOW... IN AIR DISTRIBUTION
CONNOR MAKES THE *COMPLETE* CONTRIBUTION

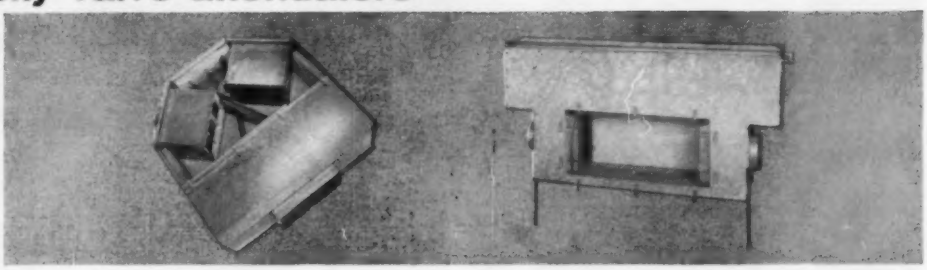
low–medium–high velocity air valves

PNEUMAVALVE—a contribution made only by Connor—adapts with equal facility anywhere that air must be controlled. Needs neither mechanical linkage nor operators. Response is instantaneous, positive, linear. No hysteresis. Minimum turbulence. A range of sizes. Bulletin K-45.



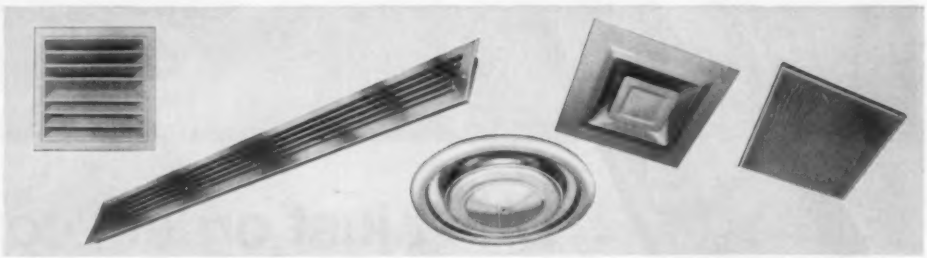
high velocity valve attenuators

At the heart of every model in Connor's Series 45P line is PNEUMAVALVE, the exclusive element that makes this Series superior for fault-free, ultra-quiet, minimum-maintenance performance. Shown are the DPC total constant volume Ceiling unit, left, and the unique DPW total constant volume Under-Window Sill-Slot unit. Bulletins K-33A, K-46, K-52, 31F.



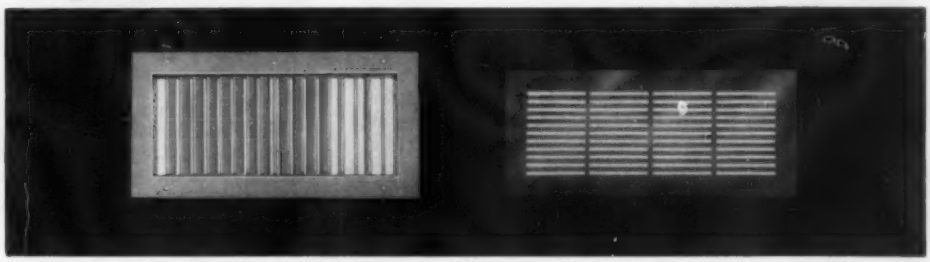
air diffusers

Shown are representative models in the complete Kno-Draft air diffuser line . . . adjustable and fixed pattern. Smart, simple styling that blends perfectly, unobtrusively with any interior, most recent additions are the KSS multi-pattern diffuser, extreme left, and the KO perforated diffuser, extreme right. Bulletins K-20A, K-27A.



grilles and registers

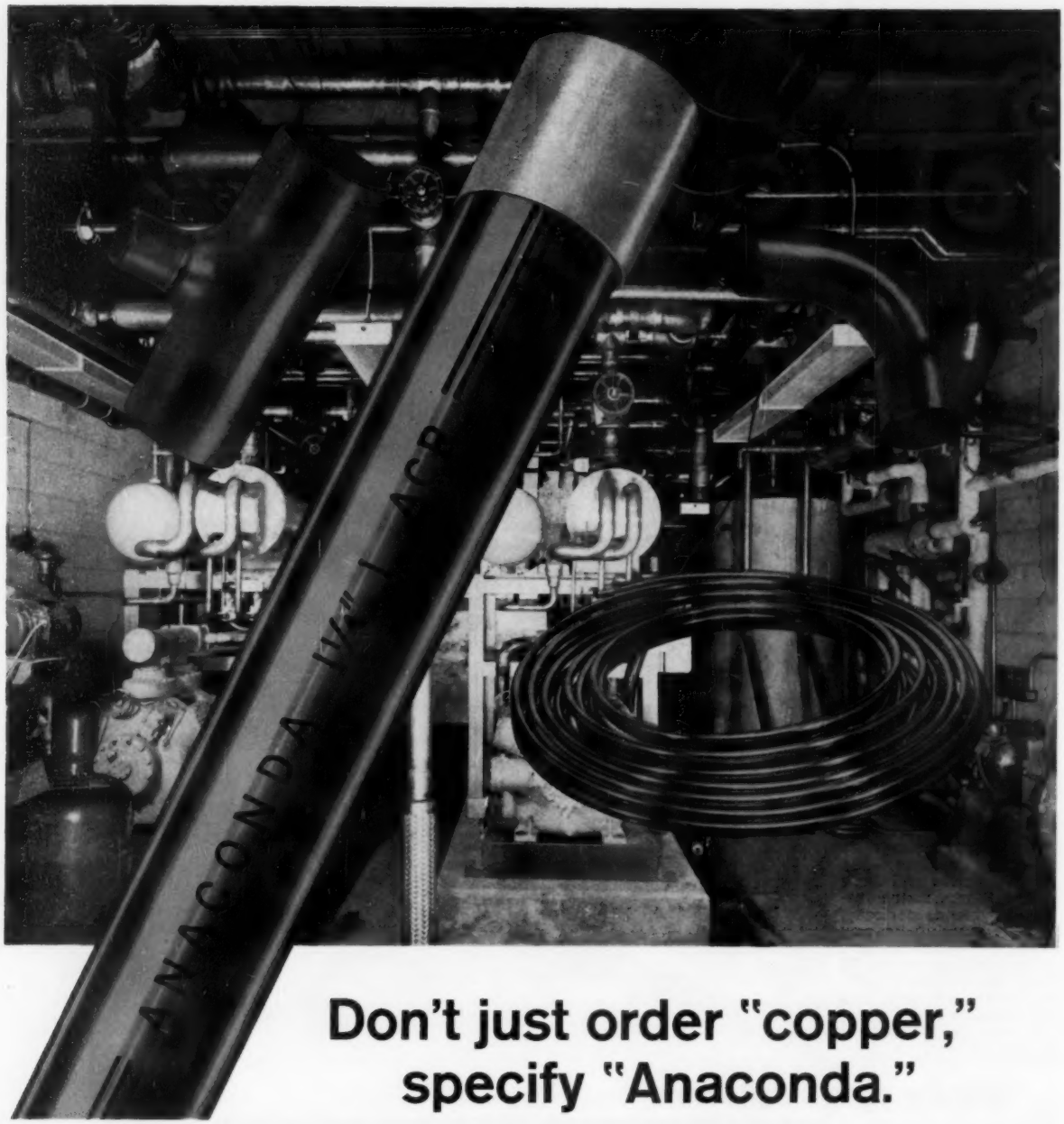
The extensive Kno-Draft line of grilles and registers offers a wide variety of face designs and rectangular configurations. Units that permit two-directional air flow, positive air volume control, other desirable features are available. Bulletin K-40.



CONNOR

DANBURY • CONNECTICUT

CONNOR kno·draft® AIR DIFFUSERS



Don't just order "copper," specify "Anaconda."

Anaconda Copper Tube is the logical choice for air conditioning and refrigeration applications because it has excellent corrosion resistance and heat transfer properties; it can be formed and fabricated easily; it is suitable for making soldered, brazed and flared-tube joints; it can be provided in specified tempers.

You will find Anaconda's new ACR Copper Tube excellent for conveying refrigerants. It is sold cleaned, dried, capped, color-coded and marked ACR . . . in 20-foot straight lengths, hard temper, Type L, in sizes from ⅜" O.D. through 6⅛" O.D.

Anaconda Copper Refrigeration Tube is available in 50 and 100 ft. coils in sizes from ⅛" O.D. through 1⅜" O.D., dehydrated, ends sealed, and uniformly soft temper.

We also offer a complete range of types and sizes of Anaconda Wrought-Copper Fittings for refrigeration and air conditioning work. To be sure of a top-quality installation, specify Anaconda Tube AND Anaconda Fittings.

For complete information about Anaconda Copper Tube and Fittings, write for free copy of Publication B-1, Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

61-729

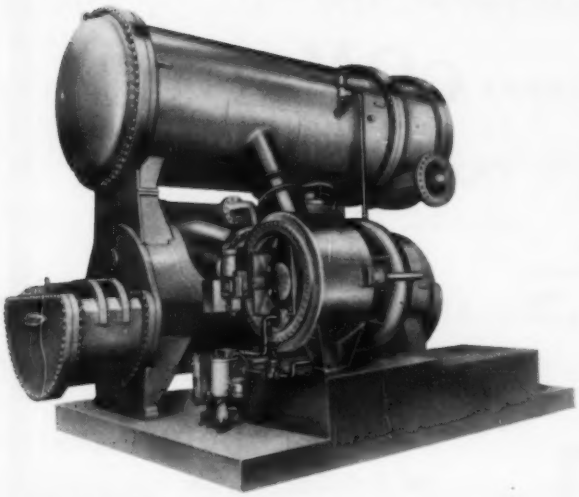
ANACONDA®

COPPER TUBE AND FITTINGS
FOR REFRIGERATION AND AIR CONDITIONING

Anaconda American Brass Company

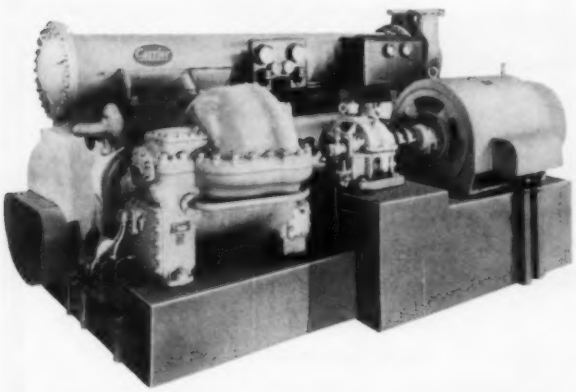
CARRIER CENTRIFUGAL REFRIGERATION CAN BE USED WITH ANY TYPE OF DRIVE

...electric motor, steam or gas turbine, diesel or gas engine!



Carrier Centrifugal—2000 to 5000 tons

With barrel type compressor—can be used with electric motor, steam or gas turbine, diesel or gas engine drives.



Carrier Centrifugal—100 to 2000 tons

With horizontal split casing—can be used with electric motor, steam or gas turbine, diesel or gas engine drives.

The versatility of Carrier Centrifugal Refrigeration Machines is practically unlimited for air conditioning, process cooling or low-temperature refrigeration down to minus 185 F.

They are available in the industry's widest range of capacities—from 100 to 5000 tons.

They can be powered with any make or type of electric motor—variable or constant speed, a.c. or d.c., high or low voltage—or with a high or low pressure steam turbine, gas turbine, diesel or gas engine.

Though "custom-built," they also offer the economy of standard units. Carrier manufactures standard compressors, condensers and coolers in a number of sizes. That makes it economical to combine standard components matched to your client's needs.

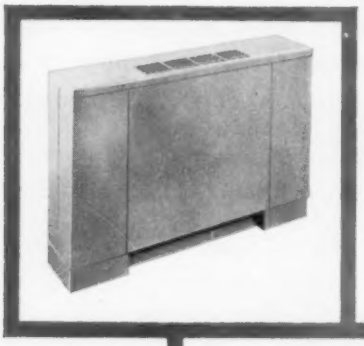
Since the first Carrier machine, installed in 1922, more than 5000 Centrifugals all over the world have proven the day-in and day-out dependability of Carrier refrigeration. You can specify Carrier with confidence on any project. Write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 14.

Carrier Air Conditioning Company

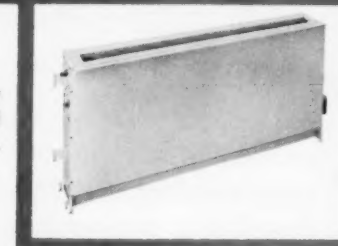
C'EST SI BON...

BOHN-AIRE

means COMFORT
in any language...
in any season!

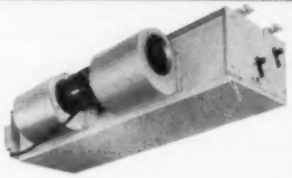


MODEL B-D for vertical floor mounting "in-the-space" or semi-recessed up to 3½".



MODEL B-V for vertical concealed floor mounting.

MODEL B-C with finished cabinet for "in-the-space" horizontal mounting.



MODEL B-H for horizontal mounting in concealed locations (plenum optional).

COMPLETE FLEXIBILITY... 4 ROOM CONDITIONERS IN 5 SIZES EACH

Quietly, dependably, BOHN-AIRE Remote Individual Room Conditioners provide year 'round comfort in apartments, motels, hotels, offices, hospitals... in any building with a central hydronic heating and cooling system. They are extremely compact with a slim 8½" width... available in concealed models or in attractive, durable cabinet styles... easy to install and service. Finger-tip push button control! Many optional accessories.

BOHN *Buy the known line... the BOHN line*
ALUMINUM & BRASS CORPORATION
Danville Division • Danville, Illinois

WATERLOO

makes a three count pledge to customers

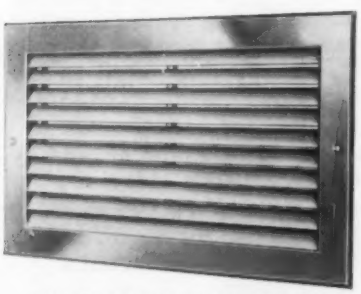
•You can be sure of getting fast service on any of Waterloo's wide range line of grilles and registers. Though we'll meet your requirements in a hurry, quality will never suffer.

•You can be certain that every Waterloo unit is easy to install. Each one is designed to assure the utmost in performance.

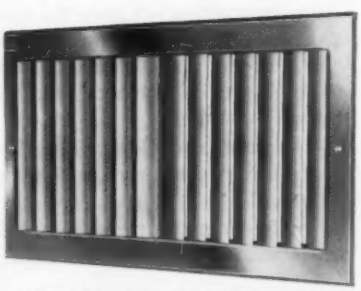
•You can count on the fact that Waterloo prices are competitive.

WATERLOO offers a complete line

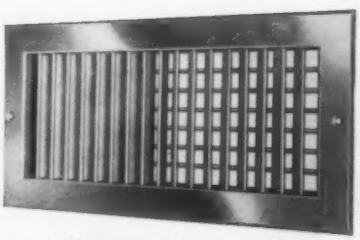
TYPICAL WATERLOO UNITS:



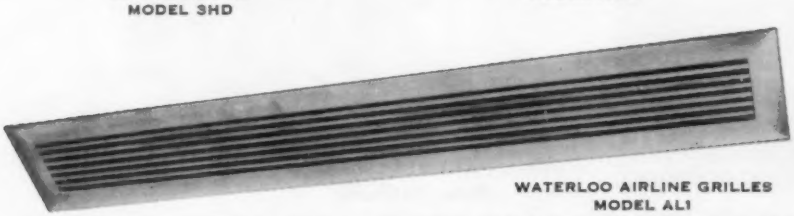
WATERLOO RETURN AIR GRILLES
AND REGISTERS
MODEL 3HD



WATERLOO CURVED LOUVER GRILLES
MODEL 1CV2



WATERLOO SUPPLY GRILLES
MODEL 2V



WATERLOO AIRLINE GRILLES
MODEL AL1

WATERLOO
Air Diffusion
EQUIPMENT

WRITE FOR COMPREHENSIVE WATERLOO CATALOG

WATERLOO REGISTER COMPANY, INC.

P. O. BOX 147, WATERLOO, IOWA

WR 121

THE BIG CONDENSING UNITS WITH THE FANDAIRE DESIGN

FANDAIRE AIR-COOLED CONDENSERS

Now Fandaire Condensing Units are available in a full range of sizes from 3 HP through 90 HP – complete with the Fandaire air-cooled condenser and single, dual or multiple compressors.

Units use the original circular design that incorporates exclusive Yuba fintube with its high heat-dissipating efficiency. Every degree of temperature drop is fully used as the circular design approaches true counterflow – where the coolest air is in contact with the coolest gas. Its powerful fan pulls air in from the sides where it is as much as 4° cooler than air from below. Warm used air is pushed up and away. As air is captured from *any* direction, *any* breeze increases the unit's capacity.

The Fandaire Condensing Unit has the highest ratio of capacity to actual size of any condensing unit on the market today.

Installation is easy – no field assembly required. Factory assembly is included in the price. Get full details today on the *big* condensing units with the Fandaire design. Special quotes on custom units.

3-30 HP (single compressor)
10-60 HP (dual compressor)
60-90 HP (multiple compressors)

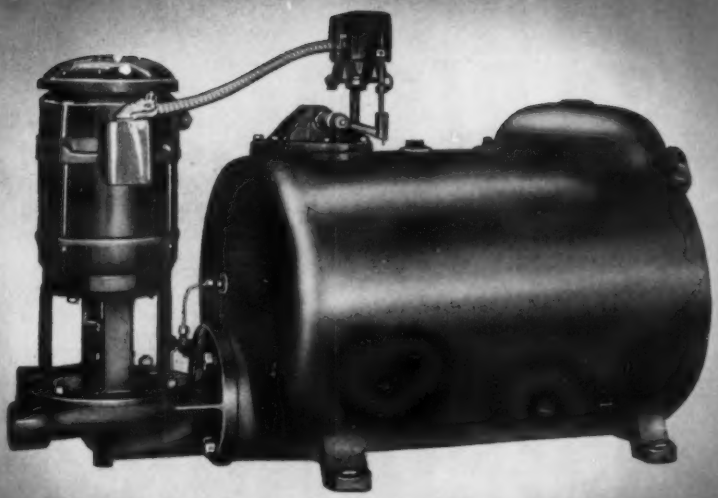
YUBA

specialists in circular air-cooled condensers and condensing units

YUBA FANDAIRE DIVISION
Tulsa, Oklahoma

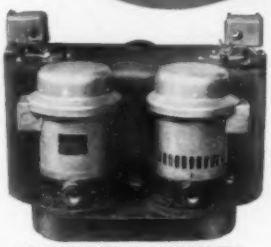
YUBA CONSOLIDATED INDUSTRIES, INC.

One is just right for your application



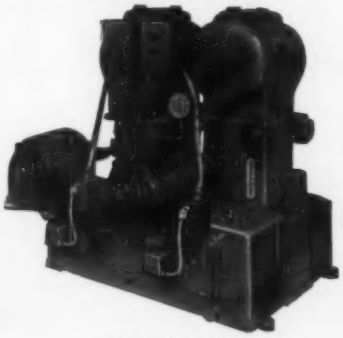
SKIDMORE "VC" CONDENSATION PUMP

- **Quiet Operation • Low inlet connection**
- **Accessibility Without Disturbing Piping**

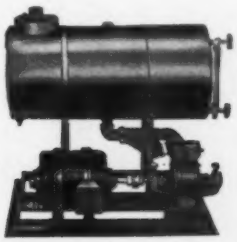


TYPE CCVS—DUPLEX
Bulletin No. 21-C

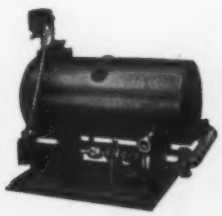
You can meet your exacting needs in heating pumps with Skidmore. For quiet, dependable operation, a Skidmore Pump combines the latest features in centrifugal pump design with a minimum of space requirements and a wide range of selectivity. Designed to return condensate to the boiler or other points . . . pump unit operates free of any close-clearances, assuring longer operational periods without cost for service or maintenance.



VACUUM PUMP
Bulletin No. 9-B



TYPE TM
Bulletin No. 17



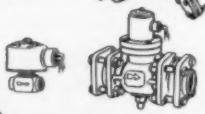
TYPE HS
Bulletin No. 14-B

SKIDMORE PUMPS

SKIDMORE CORPORATION, ST. JOSEPH, MICHIGAN

WANT PEAK PERFORM-ANCE AIR CONDITION-ING*?

Buy Sporlan *Catch-Alls*... ...*See-Alls*...

Solenoid Valves...  ...*Thermostatic Expansion Valves*... and *Refrigerant Distributors*...

They're the Perfect Combination for any size installation!

* Yes, and you can be sure of right down the line peak performance every time with:
a Sporlan Catch-All... the first molded porous core filter-drier
the amazing See•All... the first combination moisture and liquid indicator
a Sporlan solenoid valve with a moisture proof layer wound coil
a Sporlan thermostatic expansion valve with a Flow Master element
and... a Refrigerant Distributor with the versatile interchangeable nozzle

See your Sporlan Wholesaler today... *he'll be glad to fill you in on all the details!*

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST LOUIS 17, MISSOURI
Export Dept. 85 Broad Street, New York 4, N. Y

WAGNER® MOTORS AT WORK

power to cool a clerical center

Two Wagner® 900 hp motors utilize easily accessible low voltage power to drive centrifugal compressors in New York's Interchurch Center

One of the newest office buildings in the city, the 19-story Interchurch Center houses more than 2,000 workers. It is completely air conditioned . . . all 400,000 square feet of it.

It's a big job, powering the centrifugal compressors in a system that is designed to air condition that much space. A job usually handled by high voltage motors, but done here by two 900 hp Wagner® Type RP open type motors rated at 460 volts, 1750 RPM. They were specified to take advantage of an easily accessible low voltage power supply, and so eliminate the expense of running in a high voltage line. How do they perform under loads created by centrifugal compressors? Simply put, they operate at peak efficiency, day in and day out.

Compact and dripproof, Wagner RP motors are packed with power and stamina. They're the perfect drives for big pumps, fans, and blowers as well as compressors. Built in frame sizes 504U through 962S, Wagner open type motors are available in ratings through 1000 horsepower.

Want your motor application analyzed? Call your Wagner Sales Engineer. His recommendations, and Wagner motors, will serve you well.

Branches and Distributors in all Principal Cities

Wagner Electric Corporation

6370 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

THE INTERCHURCH CENTER

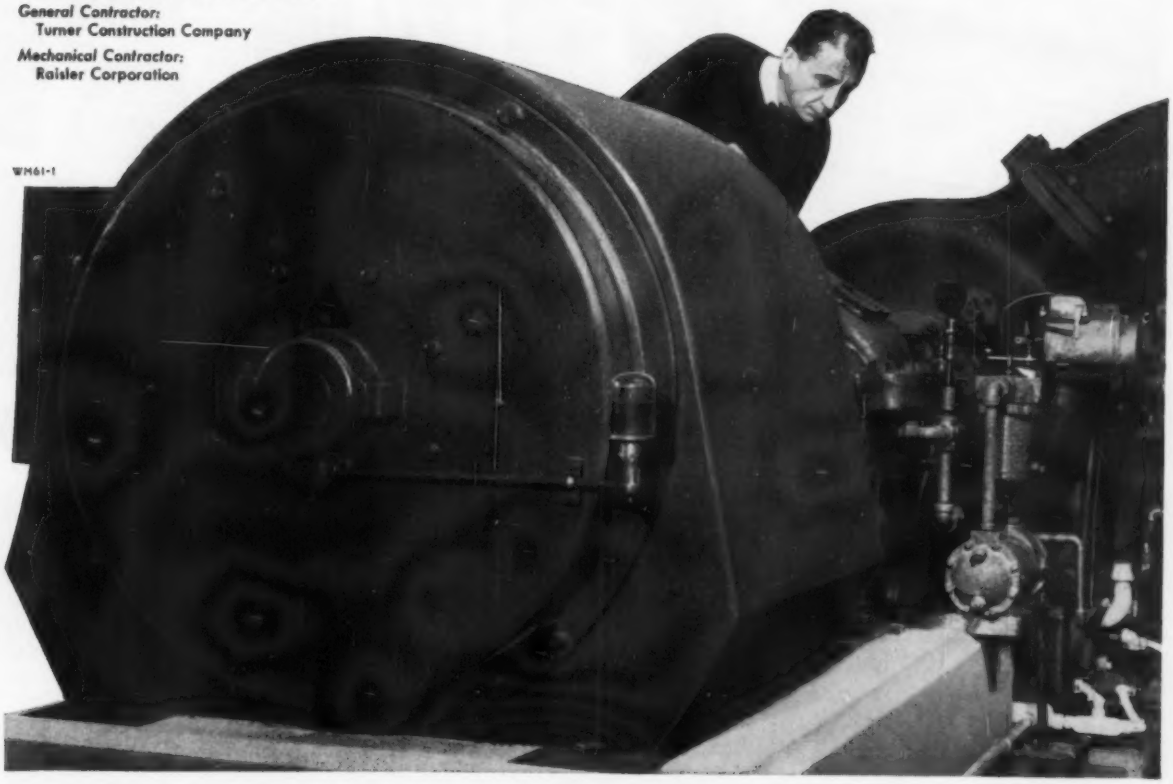
Owner: The Interchurch Center

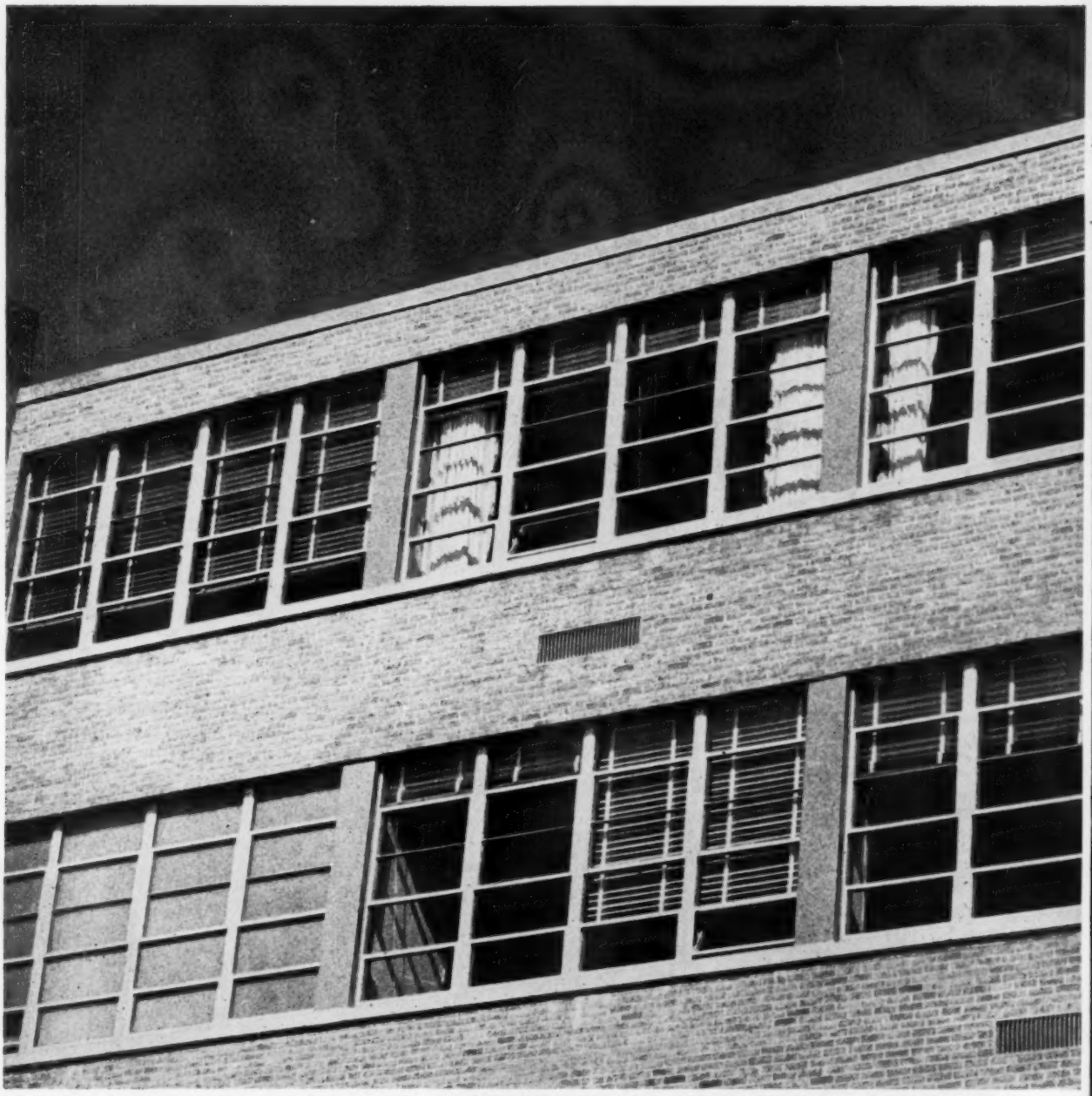
Architects:
Collens, Willis and Beckonert
Vorhees Walker Smith Smith & Haines

General Contractor:
Turner Construction Company

Mechanical Contractor:
Raisler Corporation

WM61-1

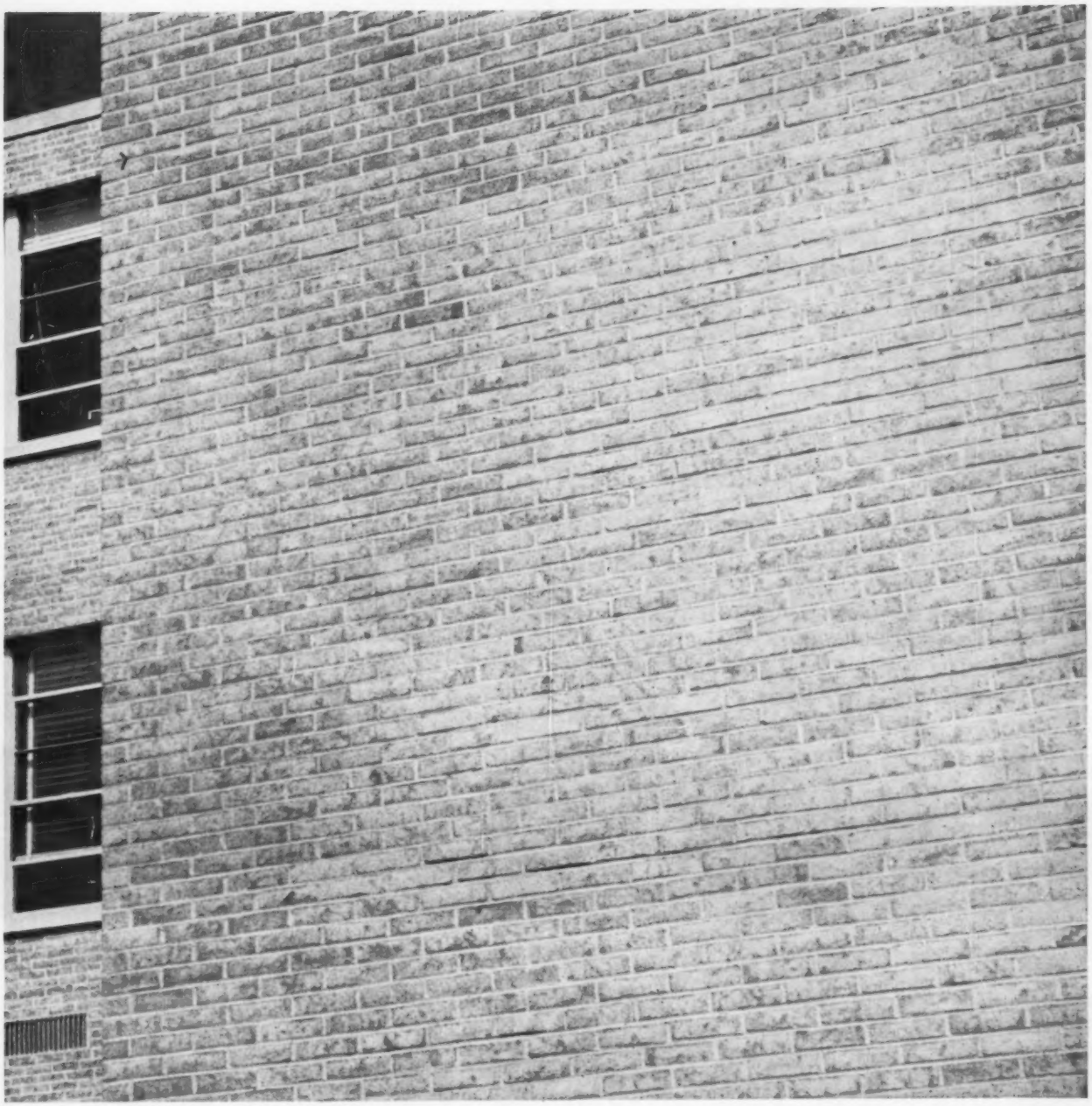




At St. Anthony's High School in Washington, D. C., one #7N5 Lo-BLAST Gas

IN WASHINGTON, D.C....cost-conscious school

Schools, private homes, clubs, government buildings, industrial plants . . . all types and sizes of buildings in Washington . . . use Lo-BLAST Power Gas Burners for top heating efficiency. With the unbeatable fuel economy of *gas*, operating costs average 10% less than with comparable burner units. And the original cost is lower, too. Versatile Lo-BLAST burners adapt easily to any boiler or furnace. With their "inshot" design, all components are outside the firebox for easy access. The *gas*-fired burners operate automatically with forced air injection, independently of vari-



Burner keeps the entire building comfortably warm, at unusually low cost.

managers heat with LO-BLAST GAS burners

able chimney drafts. You get greater combustion efficiency with all the convenience, economy and safety of modern *gas* heating.

Heat for less with *gas!* For information on Lo-BLAST Gas Burners—and their small counterpart, the Economite—contact your local Gas Company, or write to Mid-Continent Metal Products Company, 2717 North Greenview Ave., Chicago 14, Illinois.

Economite and Lo-BLAST Power Gas Burners operate silently, cost less to install, are well suited for down-draft boilers, and are available in capacities from 70,000 to 20,000,000 BTU.

American Gas Association

FOR HEATING GAS IS GOOD BUSINESS!

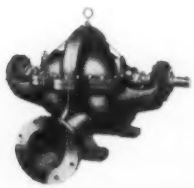
SOLVE THESE 10

MAKE PEERLESS YOUR ONE CALL SOURCE. You'll find a wide model choice within each type of pump. You'll get quick, courteous help from a trained representative who understands your installation. You'll get good technical assistance if you need it. You'll receive good delivery service, and equally important back-up service after the sale. So be job wise. Specify, buy and install a quality Peerless Pump for all the water handling needs in your building. To obtain bulletins listed below, write Peerless Pump, Hydrodynamics Division, Food Machinery and Chemical Corporation, 301 West Avenue 26, Los Angeles 31, California or 2005 Northwestern Avenue, Indianapolis 8, Indiana.

PEERLESS PUMP, HYDRODYNAMICS DIVISION
Los Angeles 31, Calif. and Indianapolis 8, Ind.
Putting Ideas to Work

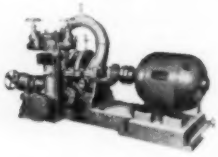
CHILLED WATER HANDLING

The horizontal split case Peerless **Type A** is ideal for this service. Easy to install. Widest application possibilities in water pumping. Request Bulletin B-1300.



FIRE PREVENTION SYSTEMS

Select from vertical or horizontal models. All Peerless **Fire Pumps** are approved by Underwriters Laboratories and Associated Factory Mutual Fire Insurance Companies. A complete package line. Outstanding service record. Request Bulletin B-1500.



CONDENSER CIRCULATION

Close-coupled **Hydro-Foil** pumps can be installed for wet or dry pit application. Extremely adaptable where space is limited. Full range of capacities. Request Bulletin B-148.

COOLING TOWER SYSTEMS

Highly flexible, the Peerless lineup of **Vertical Industrial Service** pumps are extremely efficient, require little maintenance. Install them inside or outside. Request Bulletin B-505.

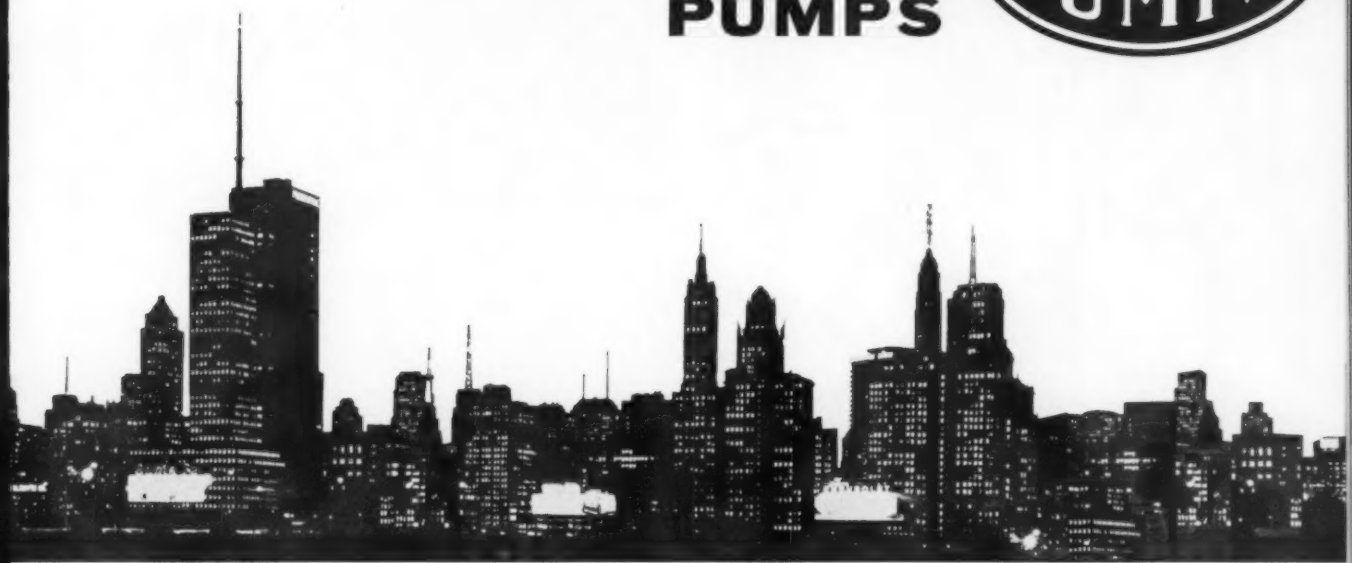
HEATER DRAIN, CONDENSATE RETURN

Peerless **Hydro-Line**® pump handles fluids with temperatures up to 400°F. Designed for operation with any available NPSH. Compact. Takes minimum space. Request Bulletin B-1700.

HORIZONTAL
VERTICAL

KEY WATER HANDLING PROBLEMS IN YOUR BUILDING WITH DEPENDABLE PEERLESS PUMPS

PEERLESS PUMPS

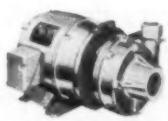


ZONE PUMPS

A highly versatile pump, the **AquaLine®** is an economical split-case side suction model. Can be applied equally well in many different pumping applications. Request Bulletin B-2100.

HOUSE SERVICE PUMPS

Apply these end-suction centrifugal **Fluidyne®** pumps in any number of uses. Economical. Models in all desired sizes. Request Bulletin B-2300.



BOOSTER PUMPS

These Peerless **TU and TUT** pumps fill an important need in today's modern building. Internal or loop crossover in these multi-stage pumps allows development of high head and capacity from a compact unit. Request Bulletin B-1400.

HYDRONICS SYSTEMS

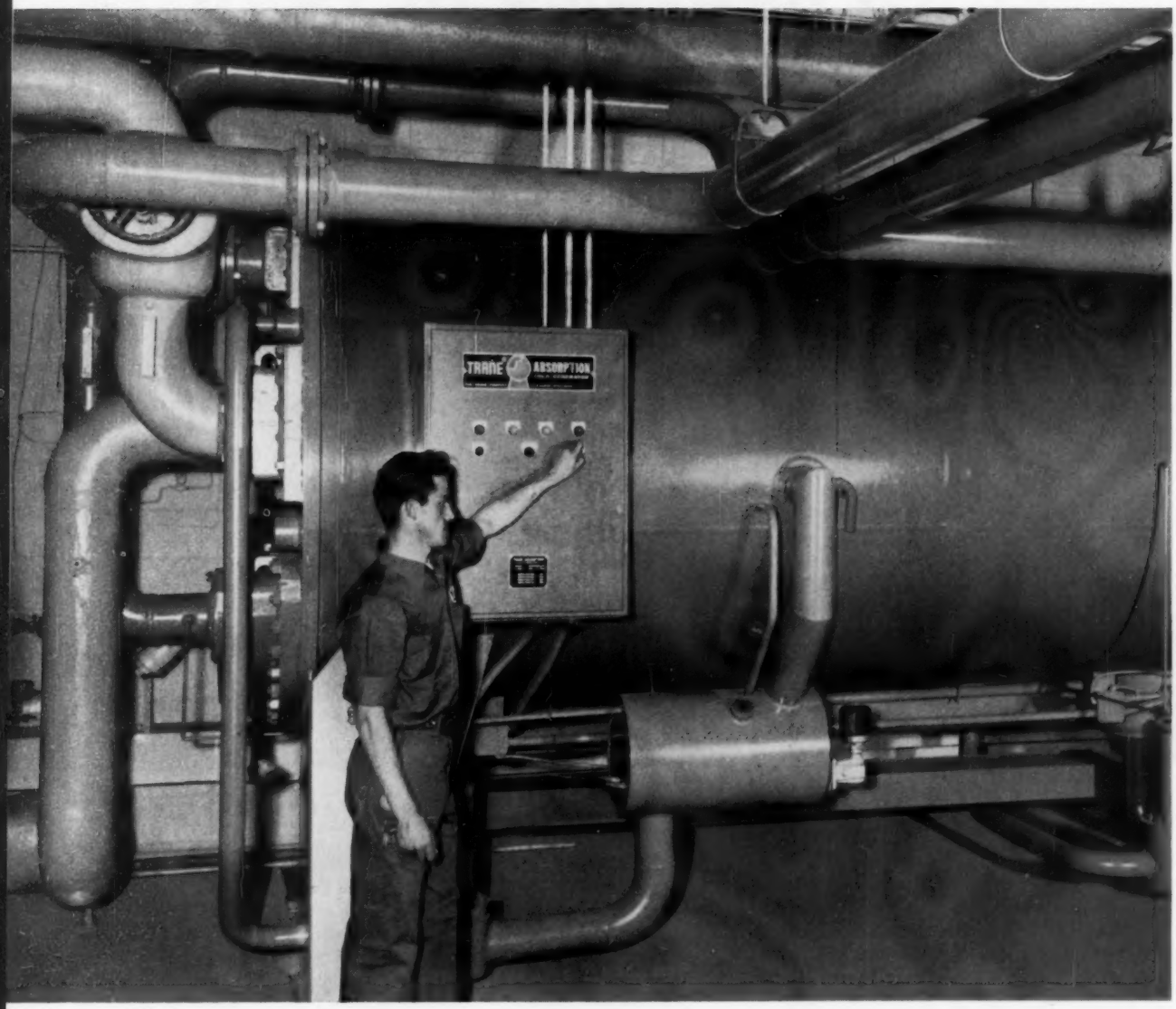
A proven-in-use series of pumps, the Peerless **DM and DMR** pumps are ideal for handling superheated water. Volutes, impellers and backplates readily adapted to tailor pump to exact requirements. Request Bulletins B-1608 and B-1610.

WATER SUPPLY

Uusurpassed record of performance in lifting water from source wells. The Peerless **Vertical Turbine** pump has wide range of capacities, setting depths to handle any need you may have. Request Bulletin B-141.

NEW VERTICAL AQUALINE It's quieter. Extremely compact. Has high efficiency record. Fits many pumping needs. Economical in price.

Exclusive hermetic design of assures dependable, economical



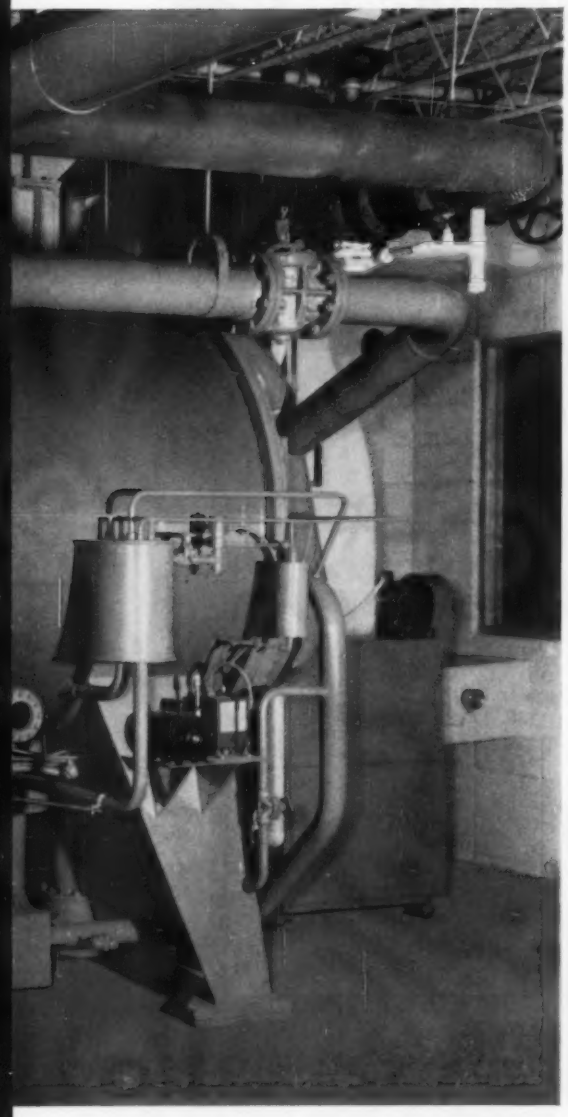
Another hospital air conditioned by TRANE: **Mt. Carmel Mercy Hospital, Detroit, Michigan, air conditioning system features a TRANE Absorption Cold Generator using low cost steam**

This 554-bed hospital received its first patient 23 years ago—in 1938. Since that time, five major additions and a continuous remodeling program have kept Mt. Carmel Mercy Hospital one of the most modern and efficient large hospitals in the United States.

The TRANE Absorption Cold Generator is located in the penthouse of the latest addition. It draws steam from an adjacent power house, and it chills water used to air condition the cafeteria, kitchen, dining room, executive offices and the children's playroom.

Because the unit does not require a full-time attendant, hospital administrators found they could free an operator for other maintenance work.

Trane Absorption Water Chiller operation and longer life



Long equipment life, superior reliability with low operating costs, minimum maintenance! The reasons more and more engineers specify TRANE Absorption Cold Generators.

Superior reliability, longer life

The exclusive hermetic design of TRANE Absorption Cold Generators assures much longer life than you can expect with water chillers having solution pumps with shaft seals. Air is prevented from entering the system where it could cause loss of capacity, increase in steam consumption, crystallization and deterioration.

All TRANE units are assembled at the factory. All refrigerant and solution piping is welded at the factory. No field welding is necessary—so every TRANE Absorption Cold Generator can be tested for air leaks before shipment with superior laboratory-type equipment. TRANE tests each unit with a helium mass spectrometer that is 10,000 times as sensitive as the best electronic leak detection equipment.

The TRANE Absorption Cold Generator—unlike other absorption machines—tends to free itself if crystallization is caused by temporarily abnormal conditions, such as power failure. Here's an actual case of how quickly and effectively this exclusive TRANE feature works: When a hurricane struck Charleston, South Carolina, there was a power failure. Within 30 minutes after power was restored a TRANE Absorption Cold Generator located in one of Charleston's largest motels, returned to normal operation. Other machines require a stand-by power source to eliminate costly crystallization damage.

Low operating and maintenance costs

TRANE Absorption Cold Generators operate efficiently down to 10% of capacity. And because these units are fully automatic in operation, a full-time attendant is not required.

TRANE Absorption Cold Generators have hermetic pumps that are automatically cooled and lubricated. The frequent and costly maintenance required by open-type pumps and complicated purge systems is avoided. There is no need for frequent seal replacements which involve draining the solution from the unit, re-evacuation, and recharging before operation can be resumed.

Wide selection is another reason why engineers specify TRANE. The TRANE Absorption Cold Generator is available in capacities ranging from 100 to 530 tons. There are twelve basic sizes for wide selection flexibility in the 100 to 530 ton range.

These are the reasons why throughout the country more and more engineers are specifying TRANE *Absorption equipment for low cost cooling of offices, hotels, motels, hospitals and factories.*

WANT MORE FACTS? . . .

Check your nearby TRANE Sales Office for more information on the TRANE Absorption Cold Generator — and for a list of installations in your area. Or write direct to TRANE, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

Manufacturing engineers of air conditioning, heating, ventilating and heat transfer equipment

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 101 U.S. AND 20 CANADIAN OFFICES

MORE

COMFORT... DEPENDABILITY... EFFICIENCY WITH ALL FORMS OF THERMAL EQUIPMENT

Consulting Engineer: Charles R. McDonald, Arlington Heights, Ill.
Thermal Agent: Barr and O'Dwyer, Chicago, Ill.

Vertical
Central Plant

Moore Business Forms, Inc., Relies on Thermal In Its Park Ridge, Illinois Offices . . .

for a dependable, long-life air conditioning and heating system, to deliver pleasant year-round comfort. From North to South and East to West—business offices and other structures are using the Thermal line of superior air conditioning and ventilating equipment to assure comfort and satisfaction. Its rugged construction warrants dependability and long life.

Thermal's wide range of sizes and models of cooling, heating and ventilating equipment permits tailoring the system to climatic and architectural requirements. The Thermal line includes central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers. For further information on air conditioning and ventilating equipment you can specify with confidence, write for complete catalog and names of nationally known concerns using Thermal.

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS

AGENTS IN PRINCIPAL CITIES

Compare Honeywell's latest air cleaner advances

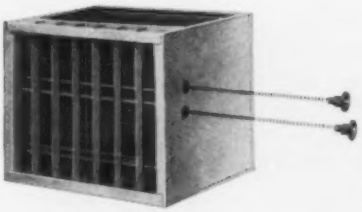
Exclusive Flutter-Jet* washing solves the problem of cleaning air cleaners

Honeywell's new Flutter-Jet washing system sweeps away collected dirt with a powerful stream of water. Its flexible rubber nozzle keeps water in larger droplets as it strikes the surface, assuring greater washing action. Attached to a moving manifold, it covers the entire area. It requires as little as 20 pounds of water pressure, and can't be clogged by salts or other impurities in the water. Flutter-Jet washing prevents breakdowns, reduces maintenance and increases efficiency.

Exclusive power safety system saves steps, assures maximum protection

A direct current sensitive relay in Honeywell's new power safety system makes it possible to control the power supply from a remote location. This permits the system to be reset without losing time going to the equipment itself. This new relay also enables you to hook the system up to a centrally-located alarm panel (see illustration), where an audible or visible alarm will be answered immediately. By providing a continuing check on equipment, it assures maximum protection and top operating efficiency at all times.

New intercell button connector cuts field installation time



Never before has it been so easy to make the electrical connections between cells. And this spring loaded ball and socket arrangement—less than 3 inches in diameter—is completely waterproof. Best of all, it features a plastic sealing ring of high dielectric strength that prevents loss from arcing as current flows between the cells. The new intercell button connector cuts installation time considerably and makes dismantling for service a snap.

New power pack features oversized selenium rectifiers for longer life

New oversized selenium rectifiers give this power pack greater dependability and a longer life. These solid-state rectifiers help stabilize the current output and maintain a constant peak inverse voltage. They are also mechanically shock resistant—a great advantage in shipping and handling. The power pack itself provides dual voltage for higher efficiency—90% at an air flow of 500 feet per minute.

Now you can specify the Honeywell Electronic Air Cleaner with even greater confidence. And only Honeywell gives you complete service back-up. Honeywell field engineers will supervise the installation, check out the equipment once it has been installed, and train the men who operate it. And an exclusive Honeywell maintenance contract assures your client maximum cleaning efficiency—through periodic inspections—for the life of the system. For details, call your nearby Honeywell office. Or write Honeywell, Dept. AC-6-111, Minneapolis 8, Minnesota.

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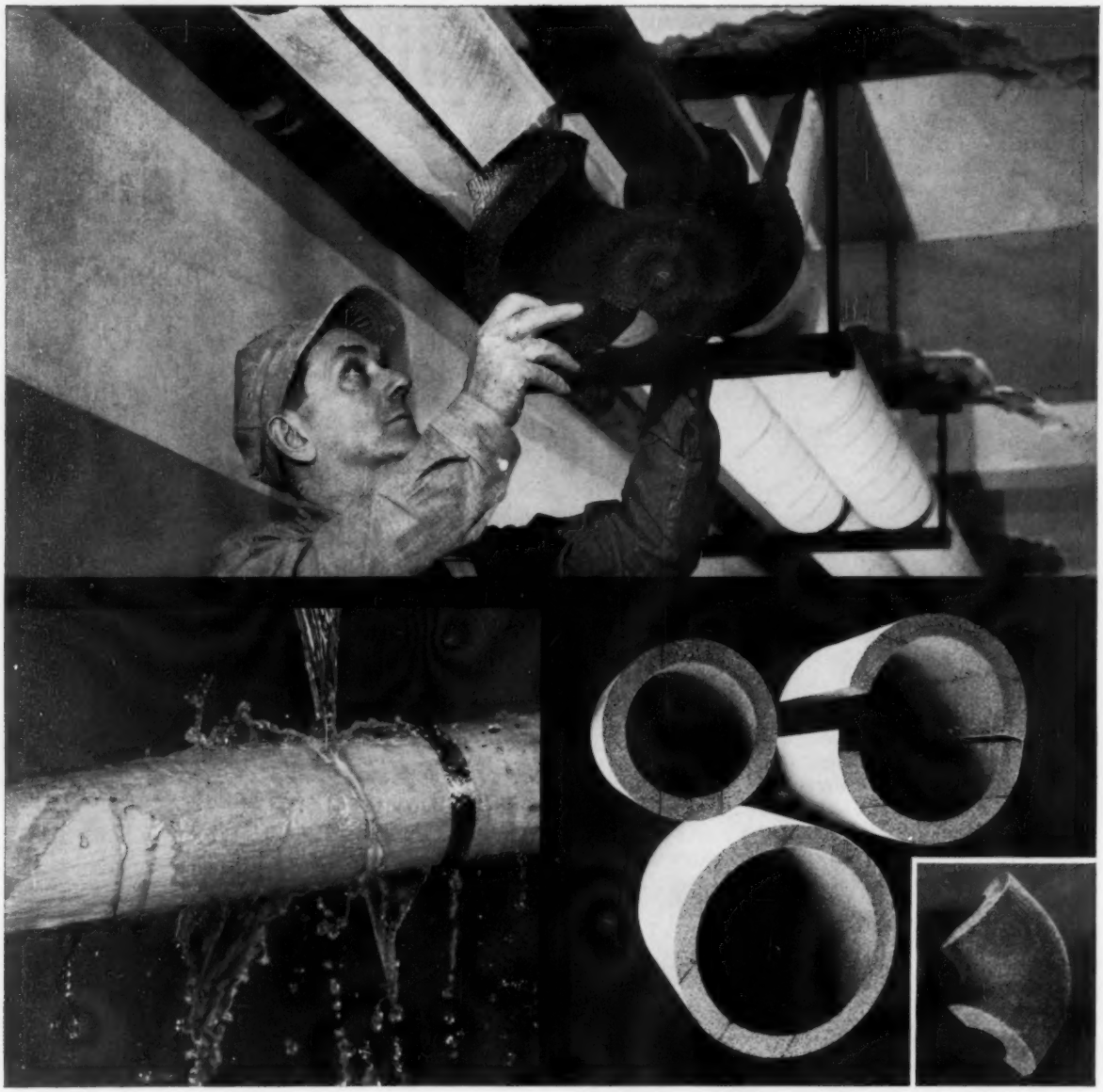
Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world. Manufacturing in the United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.



Original specification of FOAMGLAS® Stay-Dry Pipe Insulation would have eliminated this costly replacement project

Digging out "buried" building piping to replace wet insulation or rusted hangers is an expensive, messy operation. Only FOAMGLAS Stay-Dry Pipe Insulation eliminates moisture problems and gives complete piping protection for the life of the installation.

Other insulations will gradually absorb moisture until problems develop—water accumulates and drips; grows into a costly trouble spot on the ceiling. FOAMGLAS Stay-Dry, however, is composed of completely closed glass cells that remain impervious to water or vapor of any kind. Condensation doesn't form; hangers won't rust. And its rigidity prevents insulation sag on vertical runs, eliminates compression at hanger points.

FOAMGLAS Stay-Dry Pipe Insulation, available in a complete range of sizes and fittings, is easy to apply, easy to cut and fit right on the job. You'll find it suitable for ice water lines, chilled water lines, low pressure steam lines, hot water and dual temperature lines.

Write for our new bulletin on FOAMGLAS Stay-Dry Pipe Insulation. It contains user stories, physical properties, data and specifications. Pittsburgh Corning Corporation, Department HP-61, One Gateway Center, Pittsburgh 22, Pa.

PITTSBURGH
PC
CORNING

Sunbury Youth and Community Center's new ice rink will provide a five-month continuous skating season despite outside temperature variations. Over 10 miles of SpanGrid Steel Pipe circulate the refrigerant in the rink.

10 miles of SPANGRID Steel Pipe installed in new Sunbury Community Center Ice Rink

Early in 1961, the new ice rink at the Sunbury Youth and Community Center, Sunbury, Pa., opened for skating. The rink area is 85′ x 185′, and over 10 miles of SPANGRID Steel Pipe are used in the refrigeration system. The pipe is covered by a concrete slab so that the rink surface may be used for summer recreational activities.

REPORT FROM THE ARCHITECT

Architect Stan Seiple, Jr., of Sunbury, reports, "Our SPANGRID Pipe order arrived in excellent condition. The pipe ends and interiors were smooth.

"More than 6,000 welds were required during fabrication, and we did not encounter a single problem with the pipe. The whole system passed the hydrostatic test with no leaks. We know it is a fine installation which will give us years of dependable service."

SPANG QUALITY ASSURES DEPENDABLE JOBS

SPANGRID Pipe is ideal for skating rinks, and for radiant heating, snow melting and refrigeration jobs, too. Its uniformity through quality-control manufacturing gives you easy bending, cutting, threading and welding. It's worth trying. Contact your nearby SPANG Pipe Distributor for service.

SPANGRID Steel Pipe is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

Steel's Symbol of strength, long life, and economy

Architect: Stan Seiple, Jr., Sunbury, Pa.
Mechanical Contractor:
The Frick Company, Waynesboro, Pa.
General Contractor:
C. F. King, Inc., Sunbury, Pa.
Spang Distributor:
Busser Supply Company, Lewisburg, Pa.
Pipe Supplier:
Sunbury Supply Company, Sunbury, Pa.

ARMCO National Supply Division

MSA reports on: A Vocabulary of Airborne Particulate Hazards

MSA hopes to stimulate through this discussion a clearer and more orderly interpretation of airborne particulate hazards. This report is directed to those of you in industry who have something to do with the moving and filtering of large volumes of air. A general knowledge of these terms will help us all communicate more effectively. Write us for help in your system recommendations.

DUSTS—Let's define dusts as mechanically generated particulate matter (usually found in the harmful size range of from 1 to 10 microns in diameter). *Nuisance or irritating dusts* have no known specific physiological response. *Fibrosis producing dusts* are local offenders, causing growth of scar tissue in lungs. *Toxic dusts* are general offenders, being systemic poisons. Toxic dusts are of two types: (1) not significantly more toxic than lead: limit of U. S. Bureau of Mines Schedule #21; and (2) more toxic than lead: materials such as Beryllium. *Radioactive dusts* include radioisotopes and inert carriers.

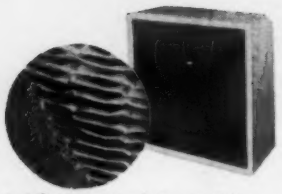
MISTS AND FOGS—Under this category falls liquid particulate (usually found in size ranges of from 5 to 100 microns).

METAL FUMES—Here lie the chemically generated solid particulates (usually generated in a size range of from 0.1 to 1.0 microns).

SMOKES—These particulates are also chemically generated but of organic origin (usually formed in a size range of from 0.01 to 0.3 microns).

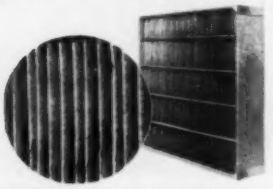
LIVING ORGANISMS—Harmful living particulates are classified under this heading. And they in turn include:

Bacteria: one-celled micro-organisms of ½ to 15 microns diameter size range. *Bacteriaphages:* .01 to .5 micron in diameter, depending on degree of clumping. *Virus:* .001 or smaller to 0.3 micron in diameter. *Pollen:* microspores from seed plants (usually found in the size range of from 10 to 70 microns in diameter). *Spores:* reproductive bodies of plants and some one-celled animals about same size as bacteria.

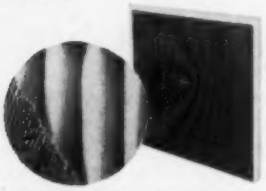


M-S-A® UltraAire* Space Filter
Light weight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pre-tested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.

M-S-A® Cylindrical-Type UltraAire* Space Filter
Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems. Weighs only one pound. Easy to handle. Inexpensive to ship.



M-S-A® Dustfoe* Space Filter
Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Stain Rating.



M-S-A® Air-O-Kay* Prefilter
Impingement type panel prefilter which can be used oiled or dry to remove lint and other large airborne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.
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Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations.

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Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators; space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.

NEW FROM BRYANT

EASY SECTION BY SECTION HANDLING

SERIES "D" 630 GAS BOILER

For new construction or replacement the advantages of the Bryant 630 Gas Boiler are obvious. Shown here is a section of one of the two 3,996,000 Btu/hr. input boilers being hoisted to the "utility tower" atop the new First New Haven National Bank in Hartford, Connecticut. The new Series "D" 630 boiler is available for water or steam. It has the new Bryant universal atmospheric cast iron burner with its superior flame characteristics, and easy adjustment to all gases, as well as to changes in their properties. You also get easier servicing and improved heat distribution across the boiler sections. Benefit by Bryant's 53 years of leadership and acceptance, factory and field assistance.

For details on the Series "D" 630 call your local Bryant Distributor or Factory Branch. Bryant Manufacturing Company, Indianapolis, Indiana.

bryant

ARCHITECT: Douglas Orr, New Haven, Connecticut. ENGINEERS: Van Zelm Haywood and Shadford, West Hartford, Connecticut. GENERAL CONTRACTOR: Fusco & Amatruda, Hartford, Connecticut. PLUMBING and HEATING CONTRACTOR: [illegible] Mongillo, Inc., Hartford, Connecticut.

Marsh Presents

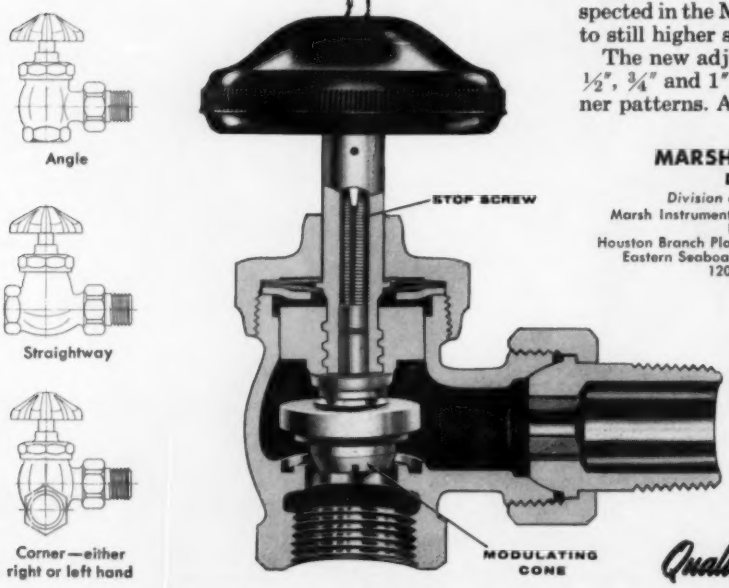
A Superior Adjustable Orifice Valve

Easy to do!

The stop screw in the sectional view below provides the orifice adjustment. Simply close the valve, remove the handle-screw and insert screwdriver in the open stem to engage slot in stop screw. Turn the stop screw as far down as it will go. Then back it off to the required orifice opening.

In a steam system, back stop screw one turn for each 10 sq. ft. of direct radiation. In a hot water system, as many turns as indicated by flow requirements of system, either precalculated or checked by devices for determining flow.

Note that valve is non-rising stem type and can only be opened to position permitted by stop screw setting. Provision is made for sealing the adjustment tamper-proof after setting orifice.



Angle

Straightway

Corner—either right or left hand

Here is the answer to easy, highly efficient balancing of both steam and hot water systems...a radiator valve in which you can accurately adjust orifice opening with the twist of a screwdriver; without shutting down the system; without breaking the union connection.

A stop screw in the valve stem, as illustrated here, enables you to set the modulating cone for any required flow: on steam, from 10 to 100 sq. ft. E.D.R.; on hot water, to any indicated flow at any given pressure.

Read opposite how simply and effectively the flow is adjusted. Once the opening is set, the special taper of the modulating cone assures the correct flow of steam or water through the orifice at any opening. In other words, the flow curve through the valve at *any* given pressure is a *straight line* throughout the full range of valve opening. Since the adjustment only limits the amount of opening, shut-off is positive at any adjustment without disrupting orifice setting.

A new valve with time-tried Marsh design

This feature is all the more significant because it is found in a valve that incorporates the truly packless, metal-to-metal seal construction so highly respected in the Marsh R-100 series and now brought to still higher standards.

The new adjustable R-105 series is available in ½", ¾" and 1" sizes; angle, straightway, and corner patterns. Ask for special bulletin.

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MARSH

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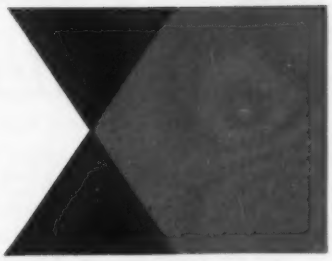
We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

Lauds Good Planning, Supervision In Existing-Building A-C Article

THE OVERALL organization of the air conditioning system discussed in the article, *Install Year 'Round System While Tenants' Work Goes On*, by R. W. Rodney in the May issue appears to have been excellent. Having recently gone through a similar experience I can appreciate the problems involved.

We, too, had the problem of air conditioning our Research Building which was built in 1936 and doubled in size in 1947. Unfortunately, only the newer portion of this building had ventilation air supply to the corridors. The original building had no air supply at all. Our central refrigeration system however, was adequate to provide all the refrigeration needed by this building.

Existing buildings present severe limitations in the choice of air conditioning systems. It was necessary for us to also study many systems before we finally were able to compromise on an installation of fan coil units. In essence these fan coil units are the equivalent of small fan rooms because they serve multiple laboratories or offices. Each fan coil system contains its own filtration section and its own reheat coil. As Mr. Rodney states in his article, a good reheat system provides excellent control and is well adapted to handle the difficult loading conditions normally encountered in a research-type building.

Mr. Rodney appears to be very well pleased with the separate contract arrangement. I heartily agree with him in this matter. We have followed this practice with success for many years. If properly used this method works to the advantage of the contractors as well as the owner.

We normally qualify the contractors in relation to the job. By carefully selecting contractors so that they are not too small nor too big for a particular job, the contractors are then able to submit a bid which offers the owner maximum value for the dollar spent and at the same time allows the contractor a reasonable profit.

Contrary to the opinion held by some people, it is to the owner's advantage to have available a reasonable number of competent contractors who are financially healthy. We have found this method of operation to be extremely successful.

Another interesting aspect of Mr. Rodney's operations lay in the hiring of a field engineer for a very specific job. This appears to offer some excellent possibilities. Owners are quite often faced with the problem of doing their own general contracting and could thereby use the services of qualified construction engineering specialists. Possibly a central clearing house for such manpower should be considered because such men are very difficult to find in our present markets.

It is always a pleasure to read about a well organized and well managed job. It appears that Mr. Rodney has been quite successful on both counts, and I hope that we can see more installations of this type being handled in a professional manner.

W. S. MAXIM
Chief Engineer Construction Design
Abbott Laboratories

Finds Gap In Engineer, Public Views Of School Central Control Panels

I HAVE READ the article, *Multi-Use School Has Multi-Zone Heating*, by W. M. Harju in the April issue and would like to comment on it.

In my opinion, Mr. Harju's statement regarding

Continued on page 88

"Open for Discussion"

Continued

the high degree of flexibility achieved with this type of heating system in modern high schools, with economy, is one of the most important features of his article.

We have found, in the Detroit area, an increasing interest on the part of both architects and consulting engineers to *give* such flexibility in both high schools and junior high schools, through the use of a central control panel such as was installed on this system. However, we have found a wide gap in the acceptance of the *use* of these control panels. Some people are completely against this idea, apparently fearing considerable added cost to the building without taking into account the possible savings that can result.

Temperature control panel installations for educational buildings need not be complicated or expensive. Panels are now being installed in many schools which are both attractive and functional. These panels add interest to mechanical systems which need to be stressed more than they have been in the past.

In addition to central control panels, we have found an increasing acceptance of subpanels at each individual fan unit which may consolidate in one control cabinet all of the control items for that particular system.

R. H. Oberschulte
D. T. Randall & Co.

More Questions and Answers On Streamlined Heat Exchanger Tubes

In reference to D. M. Adams' research report *How Finned Streamlined Heat Exchanger Tubes Perform*, (February) this will no doubt be of considerable interest to all users of tubular heat exchangers, as indeed it is to me.

The figures for heat transfer rate on the air side appear to differ considerably from the figures reported, I believe, by Professor Lander in this country around 1935, and it occurs to me that the differences may be due to differences in test procedure and/or definition of basic reference parameters.

Mr. Adams' work makes no reference to the consequences of variation in water flow rate within the tube (heat transfer, resistance of flow, etc.). Since the wetted perimeter is the same for both tubes, it is presumed that the same Reynolds number may be used for both tubes. This appears to be in order for the air side, but is this the case for the water side tube coefficients? Here, the area for water flow for the streamline tube is only half or less that of the circular tube. This means that for the same heat transfer, through the same perimeter of the tube to obtain the same mean temperature, the same water quantity must flow, and hence the water flow rate must be at least doubled for the streamline tube.

By the usual established laws of heat transfer, the water side transfer rate varies approximately as the 0.8 power of the mass flow and the water pressure head loss as the square of the flow rate. Hence, doubling the water flow rate may, therefore, account for a 75 percent increase in the water side heat transfer rate and a pressure increase of four times; assuming, of course, that the water side Reynolds number is 3000 or over. This fact may materially modify the overall economics of the problem.

Will Heat Transfer Increase Greatly?

Further, if during the trials here reported the water side Reynolds number for the circular tube was less than 3000 it might well be that the increased flow rate in the streamline tube might result in a considerable change in water side heat transfer, namely, up to five times or more due to the transition from viscous to turbulent flow.

It will be appreciated from the foregoing that this subject is of considerable interest to me and I wonder if it is possible to obtain a more complete report of Mr. Adams' work with full details of both air and water side flow rates, together with location of test points as well as magnitude of temperatures and flow rates.

Stan E. Nelson
B.A. (Cantab.) M.I.H.V.E.
Naval Construction Division
Ship Department
Admiralty Offices
England

The Author's reply — I appreciate your interest in finned streamlined heat exchanger tubes. I would like to answer your questions and comments specifically.

In brief summary, you brought up the following points:

1) The figures for heat transfer rates on the air side differ considerably from the figures reported by Professor Lander in 1935.

2) Effect of water side coefficients and internal pressure losses on performance characteristics of the finned streamlined tube.

3) Effect of the water side Reynolds number on the overall economics of the problem.

4) More complete information is desired on air and water flow rates, magnitude of temperatures, and location of test points.

In answer to the above:

Continued on page 90

When you need fast, easy opening and closing with a leak-proof seal and straight-through flow with minimum pressure drop specify

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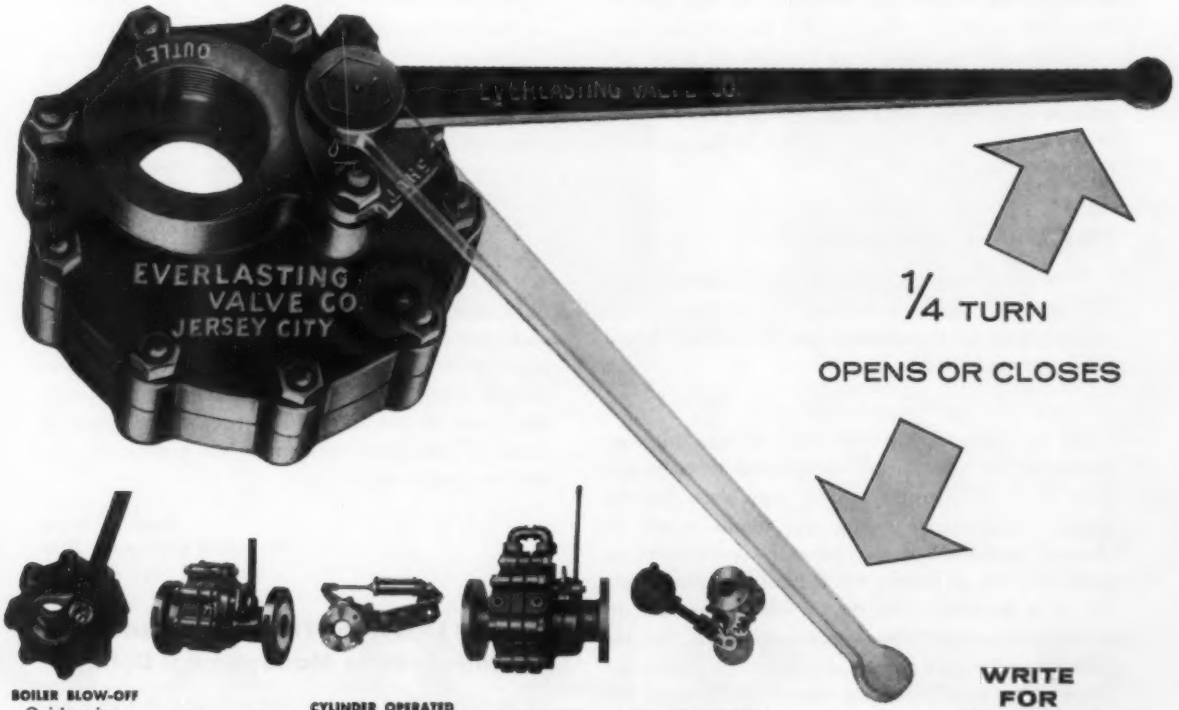

BOILER BLOW-OFF Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.

GENERAL SERVICE Where drop-tight seal and full flow is essential.

CYLINDER OPERATED Can be remotely controlled, electrically or manually.

STEAM JACKETED Assures free flow of viscous materials.

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WRITE FOR BULLETIN

EV-409

EVERLASTING VALVE COMPANY, 61 FISK STREET, JERSEY CITY 5, N. J.

"Open for Discussion"

Continued

1) In your letter, you did not state whether Professor Lander's data pertained to finned streamlined or finned circular tubes. If pertaining to the former, I would be very interested in locating and reading his work since very little information is available on the subject. If pertaining to the latter, the disagreements in the data could be attributed to the relative amount of free air stream turbulence that existed in the two set-ups; that is, the Reynolds number over a test section does not indicate the intensity of free air stream turbulence that exists upstream.

Good agreement was obtained by comparing both the results for the bare and finned circular tube with those of Griffiths and Awbery. Their test set-up was similar to that used in my studies and investigation.

2) Since the cross-sectional area of the streamlined tube was ½ that of the circular tube, the velocity through the former was twice that through the latter tube. Using the Dittus-Boelter heat transfer equation for turbulent flow and the definition of the hydraulic diameter, the water side coefficient for the streamlined tube is about twice that for the circular tube. For constant water flow rates through the tubes (21 lb_m/min), the internal conductances were not negligible in either case. This can be noticed from Fig. 4 in the article where the air side conductances reveal the differences.

Cites Method Modification

To modify the results for negligible internal conductances, the equation for the ratio of the air side conductances for the circular and streamlined finned tubes was calculated to be

$$(hA)_{fs}/(hA)_{fc} = 0.4345\ (N_{re})^{0.1493}$$

For the range of air flows used, the air side conductances for the finned streamlined tube ranged from 44 to 80 percent greater than those for the finned circular tube. Thus, the results would be changed somewhat if the internal conductances in both cases are negligible, but it must be noticed from Fig. 4 in the article that the fin effectiveness for the finned streamlined tube increases, whereas, for the finned circular tube, it still decreases. Therefore, for equal water mass flows, the overall conductance will approach the air side conductance as the water flow is increased, and the results will vary between the two given cases (negligible and non-negligible internal conductances).

As a consequence of the increased internal velocity, the pressure losses through the streamlined cross-section will be roughly four times those through a circular cross-section. The water pressure energy losses (pressure loss times specific volume roughly) were not studied since their magnitudes were small in comparison to the air pressure energy losses over the test section. For example, the ratio of pressure energy losses for air to pressure energy losses for water, for equal pressure losses and mass rates, at moderate temperatures, is about 900 to 1.

Pressure Losses Increase Pump Sizes

The pressure losses in both cases will be realized in increased pumping requirements of the same relative order. The increase in pumping requirements due to water pressure losses (oftentimes in in. of water) through the tubes is comparatively small when speaking of the total pumping requirements necessary to deliver water at gage pressure to overcome the head resistance and also to maintain the desired system pressure and flow rate. However, for air, this is not so. For example, a 4 to 16 percent reduction in pumping requirements (air) was observed for the finned streamlined tube because of the lower external air pressure losses relative to the finned circular tube.

3) The Reynolds numbers through the tubes were in the turbulent zone for both geometries (N_{re} = 18,000, approximately, for both geometries) so that the results presented in the article would not be affected by the laminar-to-turbulent transition. The Reynolds number is about the same for both tubes because the increase in relative velocities is offset by a decrease in the relative hydraulic diameters.

4) The air flow rates for the tests ranged from about 27 to 190 lb_m/min. and the water flow rate was approximately constant at 21 lb_m/min. Ambient air (approximately 95 F) was forced over the tubes, and water at approximately 200 F was forced through the tubes. The mean temperature differences ranged around 100 F. The location of test points are given in the thesis. The twenty-four pages of data and calculated results were not presented in the text for brevity sake.

DAVID M. ADAMS
Mechanical Engineering Dept.
Oklahoma State University

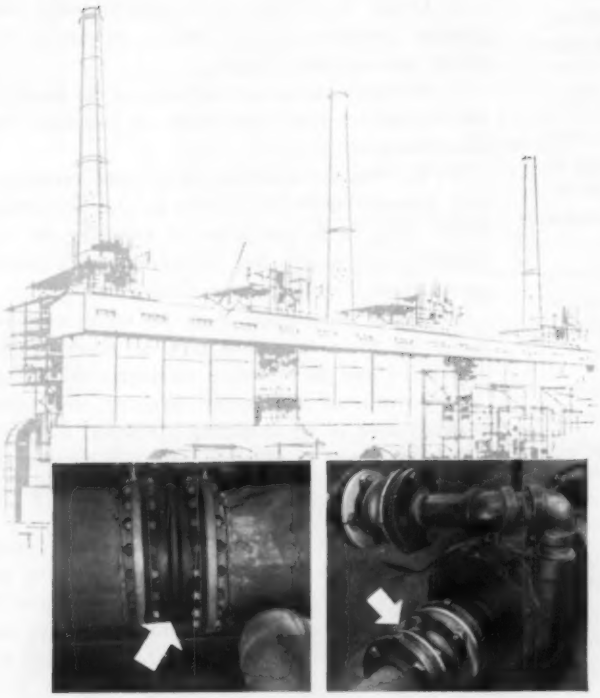
Proper Operator Training, Licensing, Incentives Save Management Dollars

IT IS A PLEASURE, as a power engineer and as a taxpayer, to see the keen interest that our Armed Forces take in improving efficiency of operation, as evidenced by the HPAC Engineering Data File Report on the *Air Force Operation and Maintenance Conference* (September 1960).

Continued on page 92

ENGINEERED PRODUCTS

for Plant Maintenance



Typical installations show Garlock Rubber Expansion Joints on a 26" vacuum condenser inlet (left) and 2½" suction and discharge pipes. Garlock furnishes standard joints from ¾" to 72" in pipe diameter, and in all shapes.

Install Garlock Rubber Expansion Joints. It's good piping practice; here is why:

1. Prevent stresses. Piping systems expand and contract with temperature changes. Garlock Expansion Joints act as a "breather" . . . compensate for expansion and contraction.

2. Eliminate vibration and noise. Pumps, compressors, engines, and pressure surges in pipe lines create vibration and objectionable noises. Garlock Rubber Expansion Joints act as an absorbent cushion . . . reduce vibration and insulate against transfer of noise to other parts of the building.

3. Compensate for misalignment. Piping and mechanical equipment often move out of normal alignment during operation due to wear, load stresses, or settling of buildings. Garlock Rubber Expansion Joints compensate for this and prevent possible breakdowns of equipment. They also make installation easier since alignment of piping and equipment need not be as accurate when expansion joints are used.

4. Reduce flange breakage. Undue stress caused by misalignment, vibration, expansion or contraction of piping or equipment, will break the metal connecting flanges. Garlock Rubber Expansion Joints relieve such stresses.

Offer many application advantages. Garlock Rubber Expansion Joints outlive metal ones; do not crack, corrode, lose shape, or require gaskets. The sturdy construction of Garlock Rubber Expansion Joints results in satisfactory service where pressures are as high as 150 p.s.i., temperatures to 180°F.

Expansion joints are also available for service up to 450°F. In the photo of the joint cut in half, the arrow points to a steel reinforcing ring which, when varied in number with the joint size, provides the extra strength needed for the most severe applications.

For more data, call the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-137, Garlock Inc., Palmyra, N.Y.

GARLOCK

Canadian Div.: Garlock of Canada Ltd.
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Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark

"Open for Discussion"

Continued

It has been my experience that a large number of industrial power plants, even though well designed, well instrumented and adequately staffed, lose untold thousands of dollars yearly for their managements due to faulty or careless operation, and through waste of the products "sold" by the power plant.

Operation which depends on the whims of the operator, who often has not been properly trained on a job which involves the use of large amounts of "direct material" results in much fuel waste within the power plant itself.

Relatively few managements, however, require more from their heating and power plants than comfort and lack of headaches caused by shutdowns or failures. If the plant and offices are warm when required, the power plant is forgotten and its operators likewise.

Standards for heat consumption, combined with standards for efficient generation, with awards or recognition for effort and good results, could go far to recoup these losses.

Licenses, dependent on plant training and examination, with their continuance contingent on results, are of utmost importance. Too often, municipal licenses are granted without proof of competence. Several years of operation, even if incompetent, count as much as years of "close to the line" effort.

Operating manuals written by design personnel who know the results desired and the methods to obtain them are an excellent idea. A secondary benefit is improved design, since faults in design, difficult maintenance, or faulty components are more likely to be brought to light.

I hope that the information presented at this conference, future developments including licensing tests, and operating guides discussed will be made available to the civilian personnel that have similar interests and responsibilities. This indeed would be a national service.

ARTHUR F. DELONG
Plant Engineer
Exide Industrial Div.
Electric Storage Battery Co.

Precautions for Handling Heavy Fuels In Air, Pressure Atomizing Nozzles

THE PROBLEM of firing No. 6 oil with complete modulation as posed by R. A. W. in "Question of the Month" has been satisfactorily solved by a number of burner manufacturers. Mr. Higgins (March issue) suggests the use of pressure atomizing nozzles. In order to achieve full modulation this would necessarily be a return flow type nozzle, unless modulation would be over a range of less than 2 to 1.

Return flow nozzles for atomizing No. 6 fuel can be satisfactory if various precautions are taken.

1) Preheat the fuel to a viscosity of 100 SSU to 150 SSU. This would mean a temperature in the neighborhood of 250 F.

2) Sufficient atomizing pressure must be supplied. 400 psi is recommended as a minimum.

3) It is necessary to filter out the particles of carbon and other foreign matter that would plug the metering passages of the nozzle.

4) Firing No. 6 fuel is not recommended with pressure atomizing nozzles with a maximum discharge rate less than 20 gph.

5) Provide some means for purging the nozzle of fuel on shutdown or some means of preheating the nozzle for starting.

We feel that air atomizing offers some advantages over pressure atomizing nozzles for handling these heavy fuels. More equipment is necessary for air atomizing equipment, but the advantages probably outweigh the disadvantages and extra cost.

The same precautions must be taken as given above for the return flow type of nozzle. Under these conditions the following advantages will accrue.

1) Because of the larger metering dimensions normally used in air atomizing equipment there will be less likelihood of clogging. This will increase the service life and the dependability of equipment under most conditions.

2) If sufficient atomizing air is available excellent break-up can be assured. If air pressure at approximately 40 psi is available, fuel to air ratios (lb of fuel per lb of atomizing air) of 25 to 1 are possible with good atomization. Better atomization will be accomplished at lower fuel to air ratios.

3) Assuming that a satisfactory external fuel metering source is available and that satisfactory combustion air mixing devices are provided, very wide turndown ratios are available with this nozzle.

Burners utilizing the air atomizing equipment are available both for single fuel and dual fuel arrangements. These burners are found mostly in firing rates from 40 gph and up. Turndown ratios of 4 to 1 are common with full modulation. The limiting factor is not the atomizing equipment, but the combustion air handling equipment.

E. O. OLSON
Chief Engineer
Delavan Mfg. Co.

A number of answers to the query "Can No. 6 Fuel Oil Be Used for Heating Large Installation Where Constant Modulation Is Required?" were presented in "Question of the Month" in the March, April, and May issues.

"Here's why I standardized on H&M cooling towers

...they're the only towers with a 20-Year Guarantee on the wetted deck surface!

"In my town, most air conditioning and refrigeration buyers prefer cooling towers for their installations. But local water conditions are pretty hard on the fill. Fungus and algae grow fast and furious—so fast that the accumulation actually blocks air flow and cuts tower capacity!

"After trying several makes, I standardized on H&M Cooling Towers. *The wood fill is specially treated with creosote applied under pressure,* and water plants and animals can't live on that! That's why the Halstead & Mitchell towers carry a 20-Year Guarantee on the wetted deck against failure due to fungus attack or rotting."

If you want towers that will last, and need a minimum of care, you should find out about H&M towers. Call your local parts wholesaler or write for Bulletin EC-500 (Propeller Fan Towers, 3 to 150 tons) or Bulletin ECKB-601 (Centrifugal Fan Towers, 5 to 30 tons). Halstead & Mitchell Co., Dept. C-6 Bessemer Building, Pittsburgh 22, Pa.

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Cooling Towers • Air-Cooled Condensers • Air Handlers and Coils • Water-Cooled Condensers

Export Representatives: Sabal-Kleimann, Inc., 15 William St., New York 5, N. Y.

"What's the Best Way to File Technical Articles and Data?"

This question was asked previously in Heating, Piping & Air Conditioning, and is repeated here, along with two answers that have been received. Other solutions or comments for publication are invited.

"I know this question has been asked before in Question of the Month, and I have read many answers which have all been very helpful. I have used some of the ideas, but still have not found the system which answers all my needs.

"I would like to see more ideas and learn of more methods that have been found workable as to the best way of filing technical information from articles published in HPAC and other magazines; data from manufacturers of equipment used in heating, piping, and air conditioning work; as well as ideas and data from other sources.

"By 'the best way of filing,' I mean the method that takes the least time and trouble, not only to put the data in the right place originally, but to find it when it's wanted.

"I am in a relatively small engineering office, and we are not large enough to have a librarian to take care of this information." — D.A.C.

Good System Requires Sufficient Time, Proper Numbering Plan, Attention

REGARDING the question *"What's the Best Way to File Technical Articles and Data?"* the following comments are offered:

For years we've been faced with the same problem. Several alternatives have been worked out but, eventually, they were discarded due to excessive work, time, and/or expense involved. Finally, we were faced with the realization that, just as there is no such thing as a cheap but efficient air conditioning installation, a professional file must conform with certain basic requirements involving a minimum of expense, time, and effort.

1) Since ease of reference is the prime goal, someone with a working knowledge of filing methods must be available to direct another person, or to do the work himself.

2) Filing tasks are time consuming. There is no way of getting around this fact.

Outlines First Requisites

The simplest, most practical system must include the following:

a) A card (or notebook) index alphabetically arranged by subject. Each card contains a single subject, with one or more folder reference numbers. Example: Condensers, water cooled (3), 7, 9

The number in parentheses represents the master folder containing the pure, unmixed data on the subject. The other numbers refer to folders containing information intermixed with other topics.

b) A family of folders consecutively numbered starting with number 1. The folders should be accordion type, with a plastic ear and insert on the superior edge where the respective number can be shown.

c) The above components will serve articles of reference, advertisements, etc. As for manufacturers' catalogs, they can be filed mixed in the same file

Continued on page 96

NEW DUCT SEALING TAPE.
Silver polyethylene tape has high quick stick, superior strength, excellent moisture sealing qualities. Conforms readily, adheres firmly.

New duct sealing adhesive forms positive seal against air leakage in high-pressure, high-velocity systems, to increase system efficiency up to 30 percent.

PERMACEL®

NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES

cabinet with the same series of reference numbers, but in folders dedicated exclusively and individually to catalogs printed by each particular manufacturer.

MARIO E. BAJANDAS
Registered Professional Engineer
Air Conditioning Design

Recommends Professional Advice, Notes Literature Available

FOLLOWING the precept that it's best to use a professional to do a professional job, I would say the best way to set up a technical reference library is to hire a professional librarian to do the job. Such persons are skilled in the art of acquiring, organizing and putting technical information to use.

A pertinent fact is that the Special Libraries Association, 31 E. 10th St., New York City, maintains a Consultant Service Committee which administers a professional consultation program. This service offers a free one day consultation with organizations seriously interested in inaugurating library service or organizing information in most of the industrial areas in the United States. The Association headquarters would be pleased to place the inquirer in contact with the appropriate person on the nearest SLA Chapter. The latter would contact the inquirer as to a suitable date for the consultation, and would bring a helpful kit of reading materials on the subject of information organization including notably the SLA book, *Technical Libraries: Their Organization and Management* (Lucille Jackson, 1951, 202 pages, $6.00).

One important consideration is that the system used to organize technical literature should be neither too limited nor over sophisticated. The free booklet, *Non Conventional Technical Information Systems in Current Use,* issued by the Office of Scientific Information, National Science Foundation, Washington 25, D. C., describes briefly systems used for handling internal research reports in 24 organizations. Some of these systems are quite elaborate, requiring the use of electronic computing machines, but others are quite simple.

The new book, *Punched Cards and Related Devices: Their Applications in Documentation,* edited by R. S. Casey and others, has been published by Reinhold Publishing Co., New York and has some very important detailed information.

Technical information is a perishable commodity; it should be used promptly, willingly and completely.

EUGENE B. JACKSON
Librarian
Research Staff
General Motors Corp.

Reader asks —

"How Can We Get Smooth Operation When Heating With High Pressure Process Steam?"

"In designing a heating system to operate in conjunction with high pressure process steam, certain questions have arisen in our office.

"The boiler is to operate at 150 psig, and condensate is to be returned through a vented receiver and pumped back to the boiler. None of the steam should be contaminated.

"In designing the heating system for the building, which will include 11 unit heaters averaging 300,000 Btu per hr output, questions concerning the selection of the traps and the disposition of the flash steam likely to be encountered need clarification. We are not sure about the trap selection — whether to use a bucket trap or a float and thermostatic trap.

"Would the intermittent discharge of a bucket trap cause more flash steam to form with resultant noises in the return line?

"Would any flash steam brought back to the vented receiver be of such a quantity as to be objectionable?

"Since the ceiling height is great and there is no danger of anyone burning himself on the return main, we have considered the possibility of leaving off the return main to insure condensation of any flash steam by the time it gets back to the receiver.

"The equivalent length to the most distant unit heater is approximately 500 ft. Pipe sizes are based on a pressure drop of 5 psi in the supply main. Should any precaution be taken for noise due to excessive steam velocity?

"We want to be sure that any banging in the return line due to the flash steam is prevented. The return piping has been sized for a pressure drop of 0.5 psi. We have considered the possibility of installing a 3 ft section of fin pipe after every trap at each unit heater to assist in condensing any flash gas. Do others think this is necessary? Are there any precautions which should be observed in particular?"—L.L.L.

***YOU ARE INVITED** to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

New Century Electric motor provides low-cost power for fans, blowers, pumps and compressors.

New Century Electric part-winding motor gives extra smooth start

This new motor . . . at either 1200 or 1800 rpm's . . . will give smooth, cushion acceleration. No cogging, jerking or jarring equipment. Just dependable starting power with the same reduction in starting current of all Century Electric part-winding motors. A special winding scheme makes this extra smooth start possible.

Applications—Have an application where power company restrictions limit inrush current? The complete line of Century Electric part-winding start motors may be the answer. They provide the most economical and dependable way of starting equipment such as fans, blowers, centrifugal pumps and compressors, as well as reciprocating compressors with unloading valves.

Reliable power—High quality construction features include . . . coils insulated with tough polyvinyl acetal resin . . . windings dipped and baked with several coats of high temperature synthetic varnish which protect against oil fumes, mild acids, dust and grit . . . rotors dynamically balanced so motors run smoothly and quietly . . . rugged cast iron frame for long life and low noise level. Century part-winding start motors are available in 20 to 150 hp sizes and in speeds of 1200 and 1800 rpm.

Application aid—A Century Electric application engineer will be glad to discuss your part-winding start problems with you. Century Electric also makes a complete line of motors . . . all sizes and types from 1/20 to 400 hp. For a copy of the new Century Electric Motor Application Guide, please write for bulletin 270A. For *more* than a motor . . .

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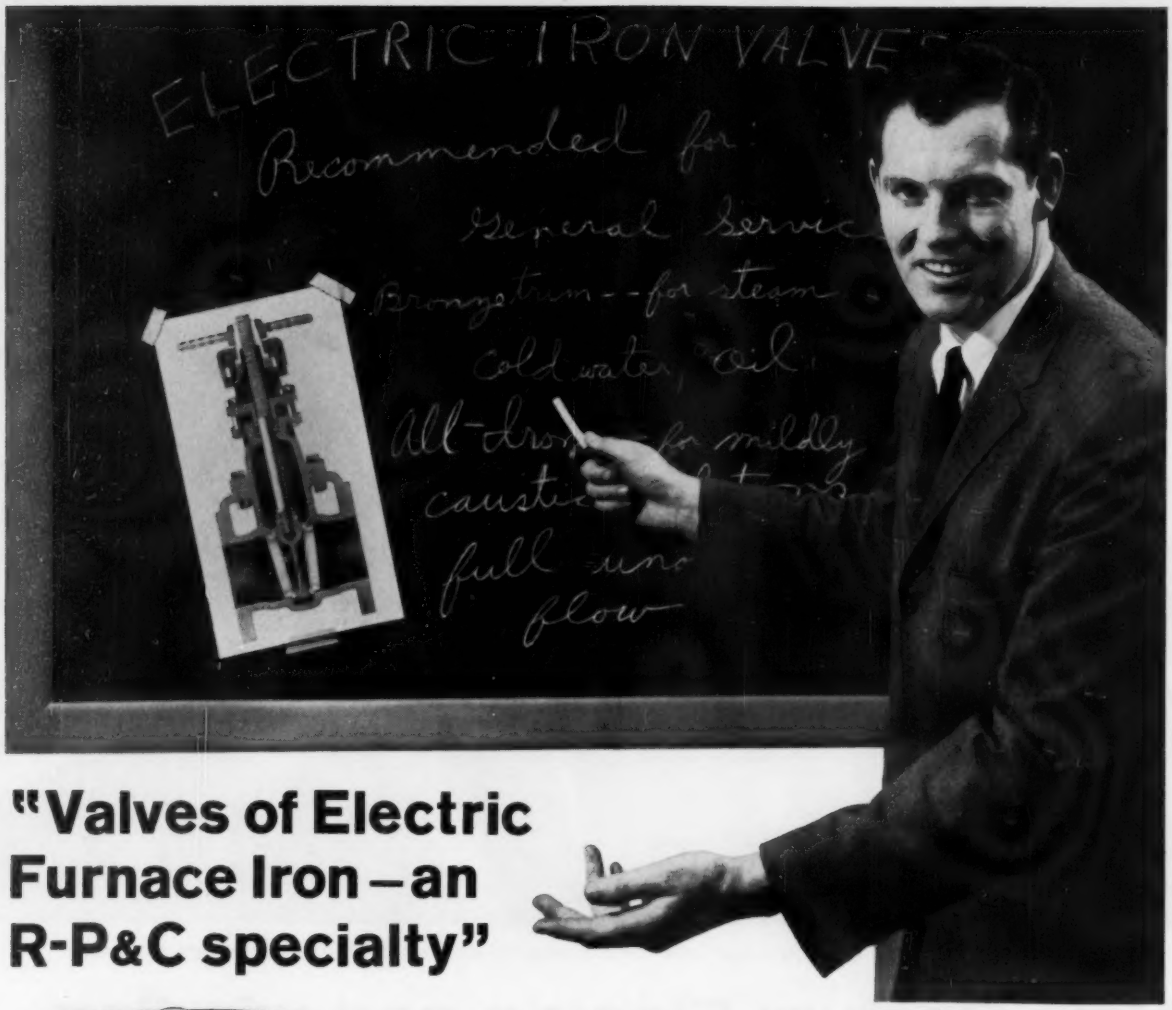
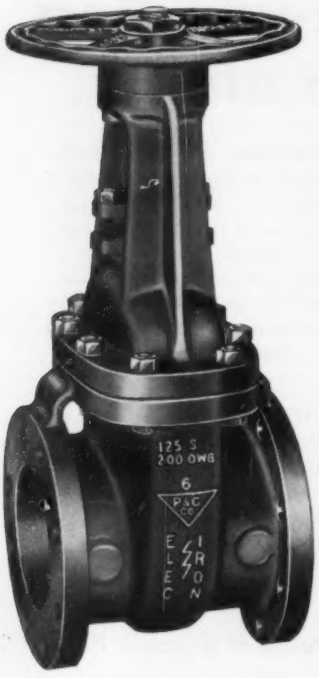


"Valves of Electric Furnace Iron—an R-P&C specialty"



"Manufacturing castings from iron melted in our own electric furnaces and to our own specifications has long been an R-P&C specialty. Recognized for their superior quality, these castings of **highly refined metal** are substantially free of impurities. Dense grain structure gives them a high resistance to corrosion, high tensile and transverse strength, plus excellent deflection characteristics. In fact, their **physical properties far exceed** the standard requirements for iron valve castings. And all of these advantages are available to you in R-P&C Electric Furnace Iron Valves at no extra cost."

Shown here is an R-P&C Gate Valve of the flanged end type. It is available in sizes from 2" to 24" in bronze trim or all-iron construction. The R-P&C Iron Valve line includes other popular types of Gate, Globe, Angle and Swing Check Valves—all made of Electric Furnace Iron.

Contact your R-P&C distributor. He can supply you promptly with any Iron Valve you need as well as gate, globe, angle and check valves in bronze, cast steel and forged steel; all in a wide range of sizes, styles and pressure classes. See him or write...

R-P&C VALVES

ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.

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Feather-floating zephyr to tropical hurricane velocity . . . you name it, and specially controlled Peerless Air Moving Equipment provides it on cue. All-welded construction keeps housing and scroll firm and quiet. Obstruction-free inlets allow air to pass through the unit at unimpeded peak efficiency. Welded wheels are statically and dynamically balanced for perfect rotation. Engineers! You can specify Peerless with confidence. Contractors! You can install Peerless with ease and assurance. Users reap the benefits of quiet, dependable, inconspicuous service.

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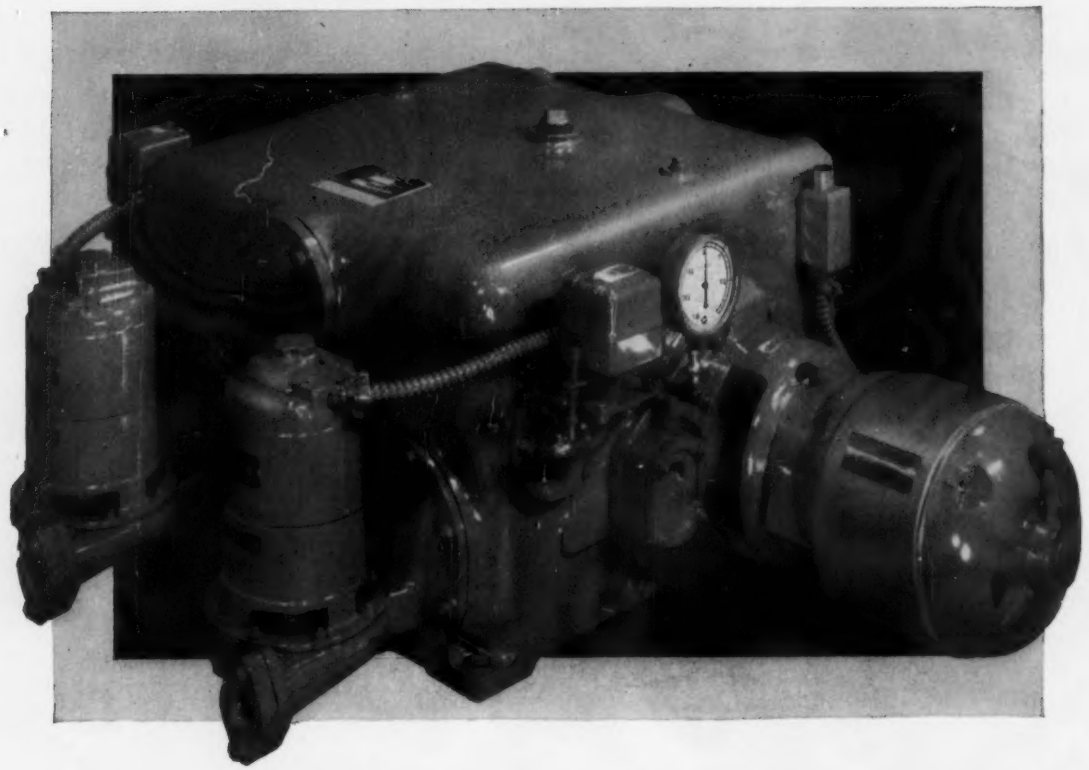
PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Member—Air Moving and Conditioning Association, Inc.

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
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• A three-duct pneumatic conveying system collects aluminum scrap from three different points on an aluminum coil and foil production line and transfers it at sub-sonic speeds to reclaiming furnaces many hundreds of feet away.

Pneumatic Conveying System Speeds Aluminum Scrap Collection

By WILLIAM S. SILBERBERG
and ALLEN M. SHORESMAN,
The Starme Co., Inc.
Consulting Engineers

R. J. ABRAMSON
Abramson & Klipp
Consulting Engineers

ONE of the most pressing problems in many production line operations is fast and economical scrap removal. Depending on the nature of the job, waste can be generated in a variety of forms and quantities, is sometimes reclaimed, and on fast moving lines nearly always is a major efficiency problem.

Sometimes the traditional man with a tote bin simply can't do the job fast enough or effectively enough. In any case he represents an addition to the payroll. Mechanical conveyor systems may be used effectively for some operations, although such systems usually involve an extensive and relatively inflexible increase in mechanical equipment and maintenance personnel, and still may not do away with the need for manual handling.

Aluminum Scrap Poses Challenge

For the Mirro Aluminum Company's new plant in Manitowoc, Wisconsin, neither of these solutions appeared to be the answer.

Among its operations, the plant starts with aluminum ingots 10 ft by 4 ft by 10 in. in size, and produces aluminum coil and foil from a high speed rolling mills.

The job includes three scrap producing stages: a 60 in. slab saw into which ingots are fed at a rate of 120 in. per minute; a drum-type scalper which removes the cast waste from the two faces of the sawed slab; and finally a high speed trimmer to remove the rough edges from the continuous foil strip after it has passed through the rolling mills.

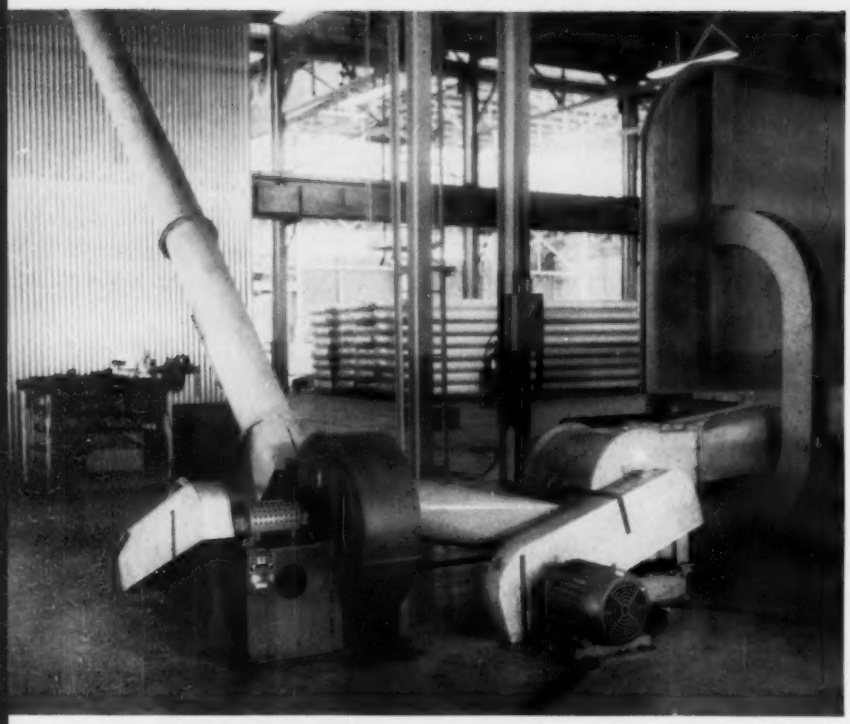
These three operations may, but don't necessarily, occur at the same time, and so for purposes of scrap removal had to be treated separately, and of course the scrap from each machine may differ in character, specification, and quantity.

Describe Removal Requirements

These are the design requirements established for each machine:

Chips from the slab saw would accumulate at a design rate of 120 lb per hr, a figure arrived at from an expected ingot weight input of 270,000 lb per day, with an approximate 0.35 percent scrap allowance.

Scrap accumulation from the scalping operation is much larger. Here, the feed rate of the billets is calculated at 10 per hr. From each billet, the blades



HORIZONTAL SPINDLE milling type scalper removes irregular cast surface from aluminum slab. Photo shows special chopper used to reduce particle size, plus materials-conveying fan with duct leading up to horizontal run

FLEXIBLE DUCT connectors for trimming machine lead directly from work level to conveying system

remove about 152 lb of waste (from two faces) for a total accumulation of 1520 lb per hr. The density of the scrap runs 3 to 10 lb per cu ft.

Foil rolls which can vary from 24 to 48 in. wide are fed into the foil trimming machine at an average weight rate of 20,000 lb per day. The trimming operation removes ½ to 1 in. from each side of the sheet. This works out to a trim equal to about 1¼ percent or 250 lb per day (31.2 lb per hr). Trimmer speed is 1520 ft per minute, with the average foil thickness 0.005 in. The minimum thickness handled is 0.0002 in., a weight which corresponds to the foil used in cigarette packages.

Design Must Be Flexible

Thus it was clear that this scrap removal problem was at least threefold; varying with the period of operation, the character of the scrap, and the speed of accumulation for each of the three machines.

All of the scrap was to be reclaimed by melting in induction furnaces located at one end of the plant. This introduced an additional factor of conveying distance.

The scalper and saw, which are close together, are more than 470 ft removed from the furnaces. The distance between the foil trimmer and the furnaces is more than 900 ft.

A system was needed which would convey all the scrap produced to the furnaces, keep the immediate production areas clear, take up as little room and

require as few people as possible, and be flexible enough so that the operation could be either expanded or rearranged at some future time with a minimum of expense.

A pneumatic conveying system was developed which accomplishes all these objectives. The system is based on accepted principles of the old science of pneumatics; uses suction to clear the scrap from the immediate work areas, and air pressure to convey the scrap over the great distances involved.

To begin with, the first consideration is the nature of the material to be moved. This encompasses the density of the matter, particle size, and the character (irregularity of shape, etc.) of the material.

The critical velocity of any material is the minimum velocity required to keep the particle in suspension in a vertical riser. Naturally the conveying velocity must exceed this value.

Calculate for Specific Material

In fact then, the system design is a design for *aluminum* scrap and only for aluminum, disregarding the similarity of some other materials.

In this case, it was necessary to reduce the particle size to a point where pneumatic conveying was feasible, as will be discussed later.

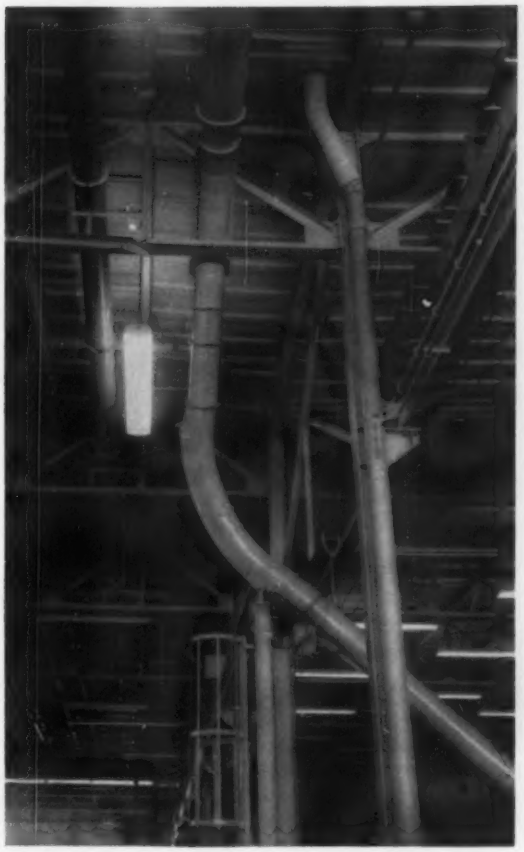
The weight of the material which can be transported per cu ft of air at the design velocity can be calculated. The carrying capacity of the air stream is also a function of the exposed area of the particle in the fluid. Therefore the governing factor in the design of the system was the ratio of the maximum conveyed load to the maximum allowable area of the particles in the fluid at any one instant.

As applied to duct sizing, the ducts for the three separate lines (saw, scalper, and trimmer) are varied in order to maintain this established ratio, with the diameter of the vertical and horizontal runs adjusted to maintain the critical velocity, relative to fan capacity and the volume of air to be moved.

Vary Intake Method

Chips from the slab saw fall freely to a collection hopper beneath the saw bed. For the scalper and trimming machines, ducts lead directly from the processing machine into the scrap collection system. The different arrangement for the saw was necessary because the blade not only rotates but moves in the horizontal plane as it cuts through the ingot.

As mentioned earlier, it was necessary to reduce the particle size of the scrap from the operations to a point where pneumatic conveying was practical. For instance, the trimmed edges of the foil accumulate largely as a continuous ribbon. Scrap pieces from the scalper may be long, and are in the shape of an



WEARBACKS are bolted in each elbow section of the conveying ducts, where most severe abrasion from fast-moving metal occurs. These are easily replaced

arc because of the circular movement of the blades.

The "heart" of the system then is a cutter arrangement, with specially designed high speed drum-type cutters located downstream in the conveying systems. Scrap is led to these, chopped to an appropriate size, and is then conveyed to the inlet of the fans.

Traps are located upstream of the cutters to remove any foreign matter such as bolts or other pieces that might enter the system, and which would be too heavy for the cutters to handle.

Special Fans Handle Metal

This is a direct-type system in that the conveyed material actually passes through the fans. These are centrifugal units with special-material wool type wheels which vary in size for the three lines. All fan and cutter motors are 480 v 3 phase squirrel cage induction type, totally enclosed, with integral cooling fans.

One of the chief advantages of the pneumatic system — the conservation of usable plant space — is claimed by raising all conveying ducts to a level just beneath the plant roof trusses. The line from the foil

UP AND OUT OF THE WAY advantage of pneumatic system is illustrated in these views. At left, scrap collection is directly from beneath slab saw. Ducts fit easily in upper reaches with other plant services, are supported at about 20 ft intervals. Gasketed flanges allow sections to be removed or replaced easily

trimming machine is also carried across a high crane bay, and is raised again at that location to clear the working area. Ducts are supported at intervals of approximately 20 ft, and are suspended by conventional means either from the building columns or from the roof supporting members.

All vertical and horizontal straight runs of round duct are of 22 gage black sheet metal, welded on the longitudinal axis and flanged at intervals so that sections can be removed and replaced, or the line altered to fit changing operations in the plant. Fiber gaskets are installed at each flanged joint.

Use Wearbacks for Duct Elbows

Duct elbows, where greatest abrasion will occur, are of 12 gage metal. An interesting feature is the inclusion of wearbacks in each elbow on the outer radius of the arc. Separate plates were rolled to form the outer side of the elbows, and are bolted to the duct proper. These can be replaced when worn, without disturbing the duct itself.

The largest ducts are required to handle the scrap from the scalper machine. Horizontal runs in this line are up to 15 in. in diameter, with 12 in. diameter vertical lines. The design capacity for the fan in this line is 5500 cfm. Vertical design velocity averages 5400 fpm, with a 4400 fpm horizontal velocity.

Ducts from the slab saw are generally smaller, with 12 in. diameter horizontal and various sizes down to 9 in. for vertical sections.

Use Booster for Trimmer Line

Because of the extreme length of the line from the foil trimming machine, an intermediate transfer cyclone is installed part way along the line, in combination with a second transfer fan. The transfer cyclone is of conventional design, except for the installation of special spiral deflector baffles to handle the aluminum material. Horizontal and vertical lengths to transfer the pieces of cut foil ribbon are all 10 in. in diameter.

Ducts Lead to Collection Cyclones

The three duct systems converge at a group of three 10 ft 4 in. cyclones located over the induction furnaces at the far end of the plant. A diverter switch gate arrangement allows any of the three lines to discharge to any of the three cyclones so that like materials can be collected separately. Again, the cyclones are equipped with the specially designed spiral de-

flectors to increase efficiency.

Collected scrap falls to a mechanical conveyor system which delivers the pieces to an inlet hopper. An extension spout from the hopper swings as required to direct the scrap to either of two induction furnaces. The storage garner beneath each cyclone is equipped with an electric eye system to indicate the build-up of scrap. As the scrap level rises, the control system acts to warn the operator to direct the scrap to one or both of the other units.

Combine Remote, Local Controls

The collection garners form the control point for the entire system. The electric control arrangement at this point can shut down any of the three scrap producing operations should the collection garners become overloaded or a failure occur in the furnace or mechanical transfer systems. A local override control at each machine can be used for start-up, local testing, etc. These local controls, however, are not normally used, and are located sufficiently far from the machine operator's station as to require a definite intention on his part to overrule the automatic function.

A main control panel for the entire conveying system is installed in the plant's electric furnace room. Here and at the machine operator's stations, warning lights and audio alarms are activated whenever the collection garners are filled to the three quarters level. Should the scrap accumulation continue, automatic shutdown would follow.

Balancing System Included

Provision is made in each of the three duct systems for introducing secondary air in order to balance the air velocities for optimum performance. For the trimmer and scalper lines, secondary air orifices are installed upstream of the scrap cutters. For the slab saw, the bottom doors of the collection hopper are adjustable to change the size of the opening.

Necessary handholes are included in the ducts close to each equipment item to facilitate maintenance and possible repair. The high speed movement of the aluminum scrap through the ducts posed one other consideration in the design of the system. All duct lines had to be grounded, because of a potential static electricity generation of some 8000 volts that could pose a hazard to personnel.

Operation Proves Design

Satisfactory operation of this scrap-handling system indicates that all the initial objectives have been accomplished. The system requires a minimum of working space, with a minimum of equipment. The labor saving feature is an important economy. When and if the layou; has to be altered for operational changes, this can be accomplished with a minimum of effort and expense. Initial installation expense was low, as is the maintenance cost.

Lastly, because the system is sized on the critical velocity basis, the actual capacity is much larger than the design requirements. ≠

COLLECTION CYCLONES are located at one end of plant over electric induction furnaces. Scrap falls to mechanical conveyors which carry metal to a hopper. Spout extension from hopper swings to either of two furnaces

● Here are some of the newer ideas in air conditioning where the chief problem is one of compensating for unusually high internal heat loads. Certain considerations may rule out the all-overhead supply/return design, and sometimes, as in the case of the data processing computer room described here, esthetics rule out the use of too many hoods and exposed ducts. Designers achieved an economical and satisfactory operation for this installation by incorporating an all underfloor supply system for both comfort and machine cooling, plus an adjustable overhead return duct system.

Mr. Grande is a graduate of the United States Merchant Marine Academy, Kings Point, Long Island. His experience prior to joining the heating, ventilating, and air conditioning department of Western Electric includes engineering service in both the merchant marine and U. S. Navy.

Computer rooms can be comfortable

New Design Approach Traps High Internal Heat Loads

By F. J. GRANDE
Western Electric Co., Inc.

THE DESIGN of an air conditioning system and the selection of equipment to be used calls for some special measures on applications such as computer rooms — where ultra high internal heat loads develop from the machines or processes.

In the past, 100 percent ceiling air distribution was the method frequently used to compensate for the high heat load from the machines, and at the same time to pick up the normal room heat load. To do this, however, it was necessary to introduce air in quantities that were quite large, with a resulting air circulation rate too high for comfortable human occupancy.

Because of this, system balancing became difficult.

Develop New Supply Design

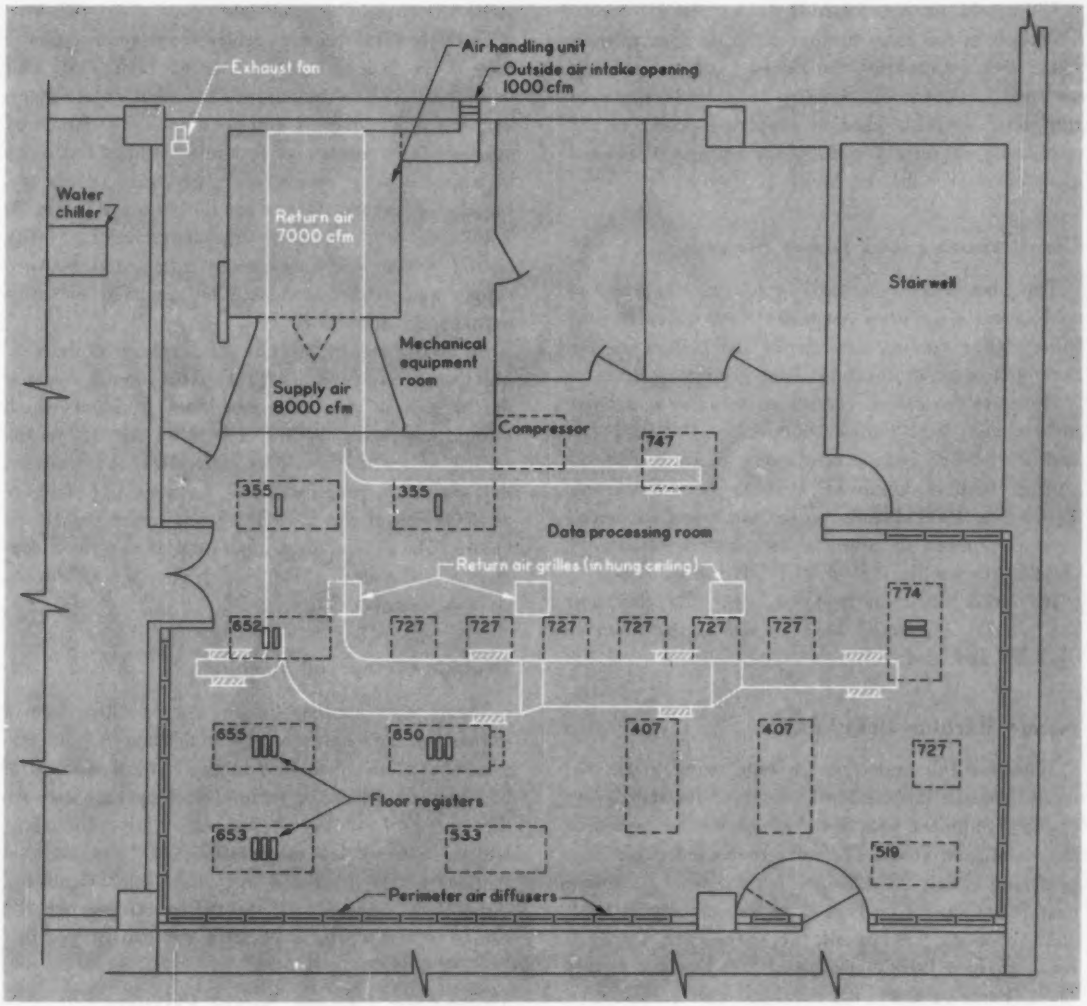
A computer room air conditioning system now in operation in the Western Electric Co. Installation Division's Chicago quarters serves to point up the difficulties mentioned above, and demonstrates how a new design approach licks the problem.

This installation is used for a computer facility where about 20 data processing machines produce a machine heat load which, added to the normal room and outdoor air load, equals some 288 thousand Btu per hr.

Calculations showed that in order to maintain a temperature difference of 17 F in the 1200 sq ft space, about 14,500 cfm of supply air would be needed if distribution were to be via ceiling diffusers only. This would mean a circulation rate in excess of one air change per minute, and the result would be a drafty and uncomfortable work area.

Consider Other Methods

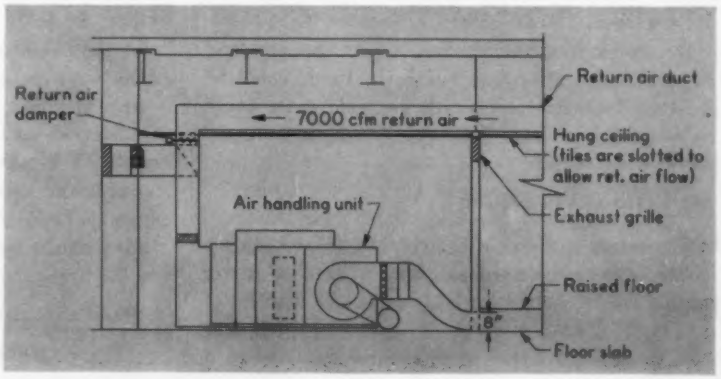
Other designs were studied, notably those utilizing exhaust hoods for the high heat producing equipment. These have proved successful in some installations where room esthetics were not an important factor. Also, designs using a combination underfloor



1 PLAN VIEW of computer room air conditioning system, with supply pattern in black, ceiling return system in white. Broken lines indicate data processing machines, identified by type numbers

and overhead air distribution system have been used, and generally these have been more successful than the completely overhead systems tried elsewhere.

Several factors made us decide to design for an air motion pattern that would move in one direction only. Such a plan would avoid collision and turbulence, which we felt was important. In addition, such a system promised to be more economical in first cost than one with a more elaborate air distribution layout.



2 ELEVATION of mechanical equipment room shows start of underfloor supply system, overhead return air duct

Ultimately, it was decided to supply all conditioned air to the room through a raised floor plenum space. Not incidentally, the raised floor was already planned for the room, chiefly to provide space to run electrical cable used in supplying power to the computing equipment and for the equipment needed to cross-connect the machines.

Use Perimeter and Direct Supply

The idea was to provide supply air for comfort cooling via a series of perimeter floor diffusers, and for machine cooling directly to the computers via floor grilles under the high heat producing units.

Here are the design conditions selected as a basis for the plan. With outdoor temperatures of 95 F DB and 75 F WB, indoor conditions of 75 F and 50 percent relative humidity were to be maintained. To do this, 1000 cfm of outdoor air would be mixed with return air to produce an air temperature at entry to the cooling coil of 86 F DB and 67 F WB.

As noted, the total heat load was 288 thousand Btu per hr. Air would be delivered to the room at 57 F DB and 55 F WB.

Isolate Machine Heat Load

With the full underfloor system, using grilles directly beneath the machines, much of the data processing equipment heat load would not be added to the room load at all. The total room and equipment heat load equals 250,000 Btu per hr, with a sensible heat factor of 0.976. This excludes outdoor air load.

In view of the size of the space, this meant a resulting heat load in excess of 200 Btu per hr per sq ft. Contrast this with the heat load encountered in a typical office installation, which may be in the neighborhood of 40 Btu per hr per sq ft.

Reduce Air Velocities

As indicated earlier, the principal advantage sought through this plan was the possibility of allowing return air temperatures to be considerably higher than they would have been with a conventional system.

By this means, the number of air changes, and the velocity of air travel within the room, could be reduced. To that extent, drafts and cold spots would be avoided.

Air Returns Via Ceiling

The return air system is arranged to pick up air at the ceiling. A return air duct is installed above a hung ceiling, which in fact consists of a series of alternately slotted tiles. Every other tile has five slots to admit 25 cfm of return air per tile, at a static pressure of $\frac{1}{4}$ in. water gage.

Only three additional grilles were required, and these were placed over points of high heat load developed by the machines. In addition however, the return air duct is equipped with 10 dampered openings as a means of providing added flexibility in adjusting the return air path when necessary. Supply and return systems are diagrammed in Fig. 1.

Because of the underfloor delivery method, with ceiling return, the temperature differential between supply and return air could be designed to range between 25 and 30 F.

At design conditions, the temperature at the ceiling can be as high as 85 F. This occurs because the high heat producing machines, each of which is equipped with its own fan, blow air up to the ceiling where it spreads by convection. Accordingly, the system is predicated on a supply air delivery of 8000 cfm at the 57 F DB temperature mentioned before. The return air temperature under these conditions is therefore about 10 F higher than the room air temperature.

Provide for Special Machine

There was another major consideration which influenced the choice of the underfloor supply system. One of the machines in the room was an IBM 774 tape data selector, which must operate between the limits of 40 to 60 percent relative humidity, and 65 to 80 F DB temperature. The remainder of the machines presented no such limit problems, since they required only a 20 to 80 percent RH range, at temperatures of 50 to 90 F DB.

Underfloor Passage Solves Problem

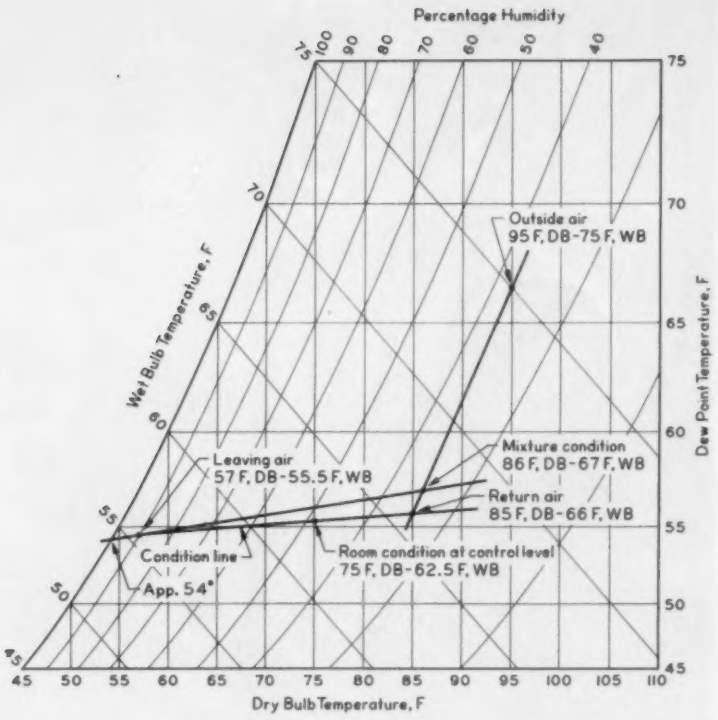
For the 774, however, it was feared that humidity conditions might be too high, and operational difficulties were possible.

The raised floor supply duct design offered a solution. It was expected that a substantial temperature rise in the supply air would occur while the air passed beneath the floor from the equipment room outlet to the tape machine — a distance of about 50 ft. It was further expected that as soon as the air passed through the supply diffuser, it would mix with the surrounding air and thus reach a relative humidity point that would be satisfactory.

Subsequent tests showed that the air temperature rose 7 F between the equipment room and the grille outlet, and upon diffusing under the machine rose another 7 F. Thus, final conditions at the machine are within required limits.

Short Circuiting Seemed Possible

The possibility of short circuiting of the supply



3 PSYCHROMETRIC layout for data processing room air conditioning is shown at right. System uses pressurized floor air distribution

air from the perimeter floor diffusers to the ceiling return air openings was considered. What actually occurs is that the cooled air from the perimeter, when delivered into the relatively warm air in the room tends to convect downward immediately, and to migrate toward the center of the room. Any hot or cold spots in the room can be eliminated by changing the air delivery either under the machines or through the perimeter air diffusers, and/or by adjusting the return air grilles or duct dampers.

The temperature gradient at head level does not vary more than 2 F from design conditions throughout the occupancy zone of the conditioned computer space.

Safety Margin Is Included

This facility for data processing is leased to users at a rate of $17 thousand per month. Since all operations must cease when temperatures rise above 90 F, it was extremely important that an adequate margin of safety be included in the equipment selection.

For this reason, a double circuited 30 ton water chiller is installed. The chiller has two compressors, condensers, and evaporators, so that one-half of the machine can operate independently of the other. With this arrangement, a possible failure of one part will not force shut-down of the entire system.

In fact, during the first few days of operation, one compressor required adjustment by the contractor, but operations continued with no real difficulty. Of course, the temperature in the room rose to 85 F, but the important fact is that the high-revenue operation continued without interruption.

Transistors May Affect Heat Load

There has been some speculation by air conditioning engineers as to the significance of transistorized data processing equipment with respect to its effect on air conditioning requirements. In the design of this system, the possibility of eventual replacement of the present computers with transistorized units was considered. The computer manufacturer informed us at the time that the basic requirements, in the event of such replacement, would vary only to the extent that the heat load from the machines would be reduced by approximately 25 percent.

Results Generate Confidence

As a result of our experience with this project, we believe that when designing air conditioning systems for high internal heat load applications, serious consideration should be given to the total pressurized floor air distribution arrangement. The operating results of this installation, which we understand to be the second of its kind in the nation and which is of course the first for Western Electric, have been by all measures most gratifying. ⧺

THIS IS a section from the second-reheat system for the Indiana & Michigan Electric Co.'s Breed electric generating station. Reinforced nozzle connections join stop valve fittings for second-reheat turbines

The Design and Installation of A Supercritical Power Piping System

By G. E. LIEN
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THE Indiana & Michigan Electric Co.'s new Breed steam-electric station was placed in operation on July 31, 1960. Located on the bank of the Wabash River some 20 miles southwest of Terre Haute, Ind., the 500 MW single boiler-turbine plant is connected by a 186 mile double circuit transmission line to the utility's Olive substation in the northwest corner of the state. The steam generator at Breed produces 3-¼ milion lb of steam per hr at 3500 psi and 1050 F, and has two stages of reheat, both to 1050 F.

Experience gained in the design and operation of an earlier supercritical pressure plant was used to good advantage for the Breed project, but whereas the first design was made to advance an already existing installation, Breed was the first to be planned from the beginning for operation at the pressures and temperature noted.

Piping Poses Challenge

Designing the piping systems for Breed Unit 1, for pressures ranging from 4600 psi to vacuum and temperatures from 1050 F to 32 F was an interesting and challenging assignment. The system required pipe runs through high, wide-open spaces and in close-quarter areas where expansion movements were the important clearance factor.

Before layouts were made, the economics of pipe size, stress, material and erection were studied, reviewed, and studied again. The main steam piping developed through many stages as the superheater outlet header arrangement was resolved. The header is located under the reheat outlets, and had to be close to the boiler, and because of expansion considerations had to be divided into four sections. This

fits the pattern of four circuits in the boiler and the four related temperature controls. Outlet headers are hung from the light boiler wall, which limits the reaction which they can accept, and considering the possible temperature variations across the superheater, this added substantially to the problem of combining pipes or of joining them in a mixing header.

Since there are four main turbine stop valves, and temperature variations are held to turbine limitations, four pipes proved to be the most economical solution.

Main Steam Piping

In view of the above, a pipe with an OD of 14 in. and ID of 7-½ in. made of 2-¼ percent chromium, 1 percent molybdenum P-22 material was selected. This resulted in a pressure drop of 122 psi with a steam velocity of 10,000 fpm, and also provided adequate flexibility and allowable end reactions. The routing is diagrammed on page 113. Forged and bored material had to be used because of the extreme diameter-to-thickness ratio. Such pipe was available in 30 ft lengths, which made it more economical.

It was possible to anchor the stop valve header in a fixed position because flexible leads were used between the stop valves and the control valve chests and turbine shell. Rigid supports were located in each of the main steam risers, fixing the location of the pipes for all expansion movements. The resulting moderate stress eliminated the need for any cold pull.

Steam Flow

First testing of the steam generator indicated that the wide variation in steam density in the 710 to 730 F range would affect the flow in the main steam lines. The only solution was to assure uniform temperatures in all four lines. A resistance orifice was installed in each pipe, with a cross-tie upstream of this orifice to a point downstream of the orifice in each of the other pipes. This meant that the piping arrangement close to the outlet headers would be complicated, but involved the smallest pressure drop in the system and also permitted the shortest procurement and erection time.

The arrangement has performed without problems since this modification. Under all conditions of flow for both water and steam the system operates quietly, and steam flow and temperatures have been equalized.

Relief Valves

In the original design, the number and set pressures of safety valves conformed to the ASME Boiler Code. This called for full relieving capacity at 10

Power piping design for a supercritical steam electric generating station — for temperatures up to 1050 F, pressures to 4600 psi — some candid comments on the problems faced during installation and testing — materials and methods

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percent over design pressure, and resulted in a requirement for 12 safety valves with the lowest pressure setting at 3850 psi. Two vent stacks were constructed, each to take the steam discharge from six valves.

In addition, two pressure switches were installed to open the superheater by-pass valves at about 3750 psi and 3800 psi. These were meant to relieve enough pressure so that the safety valves would never open. Interlocks on the steam generator served to shut down the feed pump if turbine valves were tripped, and to shut off fuel if water flow dropped below minimum.

The pressure switch arrangement provided all the relief capacity needed during initial operations, and the safety valves were never popped. Unfortunately, the quick opening of the by-pass valves produced very severe hammering in the lines whenever the valves were opened to cold pipes.

As a result, the pressure switches were by-passed for more gradual opening of the by-pass valves under hand control.

When piping modifications were made to mix the steam in the four main leads (and a special case was presented to the Indiana Boiler and Pressure Vessel Board) the technical analysis which formed the basis of the modification showed that safety valves were unnecessary, since the maximum possible pressures were still less than one-quarter of the pressure required to cause a rupture. However, it was decided to retain four of the 12 valves, and to reset the lowest to 4500 psi.

An Unexpected Test

On January 1, 1960 arcing occurred in the exciter of the low pressure generator, causing a trip of the unit from 495 MW. Within three minutes, pressure built up to 4500 psi and the lowest set safety valve popped. Severe pipe shaking and much noise was experienced, and some steam blew back into the building instead of going out the stack. This in spite of the fact that the stack had been designed to handle blow-off from six valves.

Apparently the shape of the stack was not satisfactory for handling steam at the conditions involved.

Supercritical Power Piping Design & Installation

By-pass valves had not been opened in this case until after the safety valve blew.

Plan Corrections

As a result of this occurrence, additional changes will be made. New individual vent stacks from each safety valve will be installed. The pressure switches will be re-connected with additional controls to begin opening the by-pass valves at about 4400 psi. These will continue to open as pressure increases, allowing the by-pass flow to build up gradually and reducing or eliminating hammering.

Reheat Steam Piping

The first hot reheat steam system combines a single outlet header, large enough to permit a single outlet connection, with one 26 in. diameter by 2-¼ in. minimum wall pipe. The material used is A-335-P-22, to carry the 950 psi, 1050 F steam at a velocity of 16,200 fpm with a 30 psi pressure drop.

The single line splits through a lateral connection to supply two stop valves. This provides the least possible pressure change as the stop valves are closed individually for testing while the turbine is operating.

Since the temperature of the high pressure turbine exhaust (cold first reheat) is only 725 F, carbon steel pipe is used. We found it economical to use two large diameter pipes to obtain low velocity and low pressure drop. The pipes are 24 in. OD with 1-¼ in. minimum walls. Steam is carried at 1035 psi at a velocity of 6900 fpm, with a 10.3 psi pressure drop. This design assigns most of the available reheat system pressure drop to the higher cost alloy pipe.

Second Reheat System

The second reheat steam system originates at two outlet headers, in each of which steam is mixed through an alternate tube arrangement. Steam then travels to each of the second reheat turbines through a pipe from each header. Each pipe splits near the turbine to supply two stop valves. One of the split sections (shown upside down) appears in the lead photograph. Nozzle connections are reinforced with a pipe sleeve and a shaped ring.

The system uses 1-¼ percent chromium, ½ percent molybdenum P-11 material in a 30 in. OD by 1-½ in. average wall pipe to carry steam at 300 psi and 1050 F.

Reheat System Supports

The reheat steam systems also utilize rigid supports in the risers to fix the pipe elevation. Constant support springs are employed to restrict supporting load variations where large movements are involved, with variable support springs and rigid supports used wherever calculated pipe movements will allow.

More Surprise Tests

The supports on the cold reheat steam lines were subjected to a shakedown test when the turbines were first rolled. The 1-½ in. drains had become clogged during the clean-up cycle and a sizeable leg of water was standing in each pipe when steam was admitted to the turbine. The heavy banging that resulted was immediately felt in the control room, and the unit was tripped.

Lines were drained before steam was admitted to the turbine again, and no damage to the well-designed supports has appeared.

Feedwater Piping

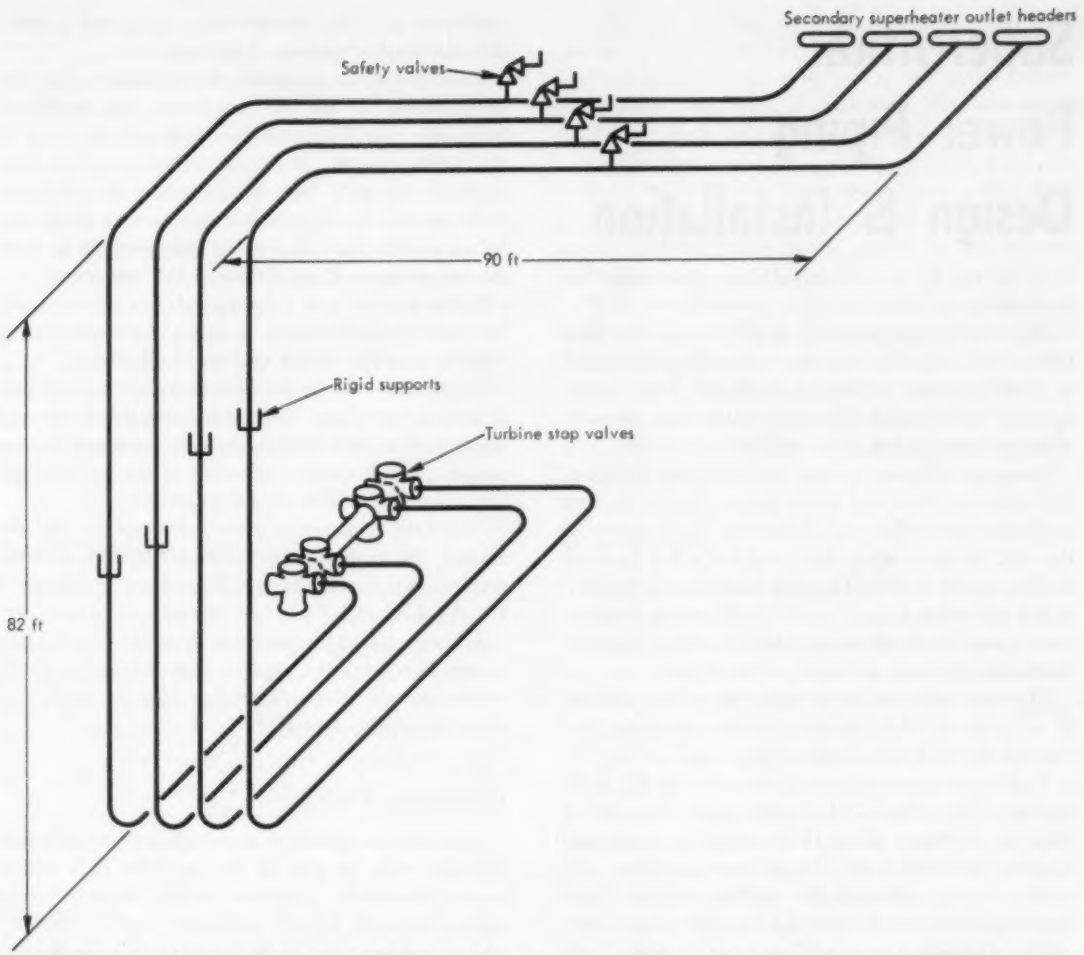
The feedwater system consists of two sections: low pressure from the discharge of the low-pressure feed pumps through heaters to the suction side of the main feed pumps, and high pressure from the main pumps in parallel streams through the high pressure heaters to the economizer.

In the low pressure section (600 psi) pipe is ½ in. average wall carbon steel, with the main flow in a 16 in. line at a velocity of 14 fps.

A 50 ft riser from one low pressure heater and a horizontal run from there to the high pressure pumps are subject to movement due to pulsating flow or pressure conditions set up by the pumps at certain operating speeds. This movement became so violent that pump operating procedures were established to avoid certain speeds or to pass through them quickly. It has not been possible to restrain the piping under this pulsation because high pipe reactions would be imposed on the pump itself. Spring type snubbers are used with guides which prevent movement other than that required for expansion.

Strainer Leaks

A twin strainer was located in the 16 in. pipe upstream of the main pumps. This unit was welded into the line, but had flanged heads and flanged valve housings. The flanges were subject to pressure variations in the line, and developed some rather ill-timed



MAIN STEAM piping layout for Breed Unit No. 1 is based on use of four-section outlet header from superheater and four turbine stop valves. Principle design considerations and installation experiences are discussed in text

leaks. The leaks developed to the point that when the cycle was fully cleaned the strainer was removed. Strainers with large flanges will be avoided in this location on future units.

High Pressure Feedwater

The high pressure feedwater system starts as an 18 in. OD by 2-½ in. average wall, A-106 Grade C carbon steel, hollow forged pipe. Where it divides into two, through each pair of heaters, 14 in. OD by 2 in. average wall pipe of the same material is used. Velocities in the two lines are 18 and 15 fps, respectively. With one set of heaters out of service and full flow through the other, the velocity in the 14 in. line doubles.

This system has operated very smoothly, even when the suction piping was vibrating severely. Feedwater shut-off valves at the economizer inlet header also serve as the high pressure heater outlet valves. All control is by feed pump speed control.

To help eliminate the pump pulsation problems, two additional leak-off valves were added to the main feed pump. This increased the leak-off flow from 600 to 1500 gpm, but required no change in the 8 in. pipe carrying the larger flow of flashing liquid to the deaerator. Liquid velocity, excluding flashing, increased from 4.5 to 11.5 fps, and the pressure drop in the line increased to more than 100 psi, but no appreciable change in noise and vibration levels has been experienced.

By-Pass Piping

By-pass piping for the Breed once-through unit originates with the superheater by-pass valves located at both front and rear of the steam generator, and extends to the flash tank in the basement. This tank also receives water and steam from the turbine by-pass valves, and is effectively a small steam drum with water drains from the bottom piped to drain valves on the condensers, and with steam vents piped

Supercritical Power Piping Design & Installation

from its top to pressure regulating valves near the condensers.

Here the design is more difficult, because the flash system must function over a pressure range of from 0 to 1000 psi, and is subject to shocks from quick-opening valves which discharge either high pressure water or steam or a mixture of both.

Pressure variation is very critical in the design of the flash tank vent and drain valves. One of the first problems arose when we discovered the inability of the tank to drain when there was but a low pressure buildup in the system. The tank and some of the horizontal pipe runs from it would flood, and as pressure was raised and steam developed, water hammer shook the system in a number of locations.

This was overcome by pegging the system with air at a pressure that would provide adequate flow through the flash tank drain valves.

Turbine by-pass valves discharge straight down against target bowls. Horizontal pipes branch off from the discharge about 18 in. above the bowls, and lead to the flash tank. During startup, when cold water is going through the turbine by-pass, these pipes vibrate violently but with negligible amplitude.

The vibration has caused supports to shake loose and wires to cut through insulation. Snubbing is impossible, and the only support aid that seems feasible is a rubber vibration mounting. Once the temperature increases, vibration subsides, and it is fortunate that after the initial cleanup of the unit cold water is circulated for only a very short time during startup.

Drain Line Control

The 10 in. flash tank drain line (velocity 7 fps) has a long route and had to be restrained with struts and spring snubbers when variable flows caused excessive pipe movements. Flow was smoothed when two of the four drain valve plugs were reduced in size. This was another case of a clash between the need for flexibility and the desire to tie the line securely against destructive forces imposed by varying flow conditions. Again, the solution proved to be the elimination of the disturbance at the source.

The 8 in. flash tank vents lead to control valves at each condenser, and these pipes also respond to the high frequency vibration originating in the valves. The vibration is a characteristic of pressure reducing valves covering this pressure range, and is tolerable for the short periods of startup.

To improve the vibration characteristics, the pipe arrangement at the HP condenser was modified. Originally, the discharge from both valves joined at the sides of a tee. It appeared that some bucking might be set up by this arrangement, so the discharge from one valve was relocated downstream of the tee. Vibration readings showed an improvement in both the frequency and amplitude of the movement.

In the future, each reducing valve of this type will be connected individually to its own condenser spray pipe, to simplify design and avoid vibration.

Steam and water enter the condenser through perforated spray pipes. This distributes the water and steam over a wide area in the condenser and insures proper cooling during operation of the by-pass system when the turbines are not in service.

The flash tank is the source of steam for the deaerator, the highest stage feedwater heaters, and the turbine seals during startup. These lines are designed for the 1000 psi flash tank pressure, and are provided with adequate slope for drainage of saturated steam. The deaerator pegging operation put so much water into the bleed steam line that an additional drain trap had to be added.

Condensate Piping

A condensate system is more elaborate on the once-through cycle because of the need for high purity water. Condenser tubes are welded into the tube sheets, but each hotwell is divided into two sections and provisions are made for sampling condensate from each of the drain connections.

If the sampling indicates that there is possible tube leakage in a segment of the condenser, this water can be pumped through the condenser drain pump back to the contaminated storage tank. From there it can be taken to the demineralizers and returned to the cycle or to the clean condensate storage tank.

This flexibility requires a double set of piping in the condenser hotwell area. The capacity of the demineralizers is based on handling the flow from one-half of a condenser over a period of time so that the unit need not be shut down immediately because of a condenser tube leak.

That portion of the condensate system in which water always flows is carbon steel. The clean condensate storage tank, and the piping from it to the condensate system, where water may stand for periods of time, are of stainless steel Type 304. Demineralized water is corrosive to carbon steel and iron pick-up by the standing water had to be avoided.

Cooling Water Piping

Two closed cooling water cycles are provided. The

turbine auxiliary cycle provides large quantities (7500 gpm) of water for the hydrogen coolers, stator oil coolers, turbine oil coolers, and the turbine seal leakoff condenser.

Water in this cycle surrenders its heat through a heat exchanger to the condensate system when condensate temperature is low, and through a second heat exchanger to the circulating water system when condensate temperature is too high. The separate cycle precludes the possibility of the main condensate stream becoming contaminated with oil, and provides for full flow regardless of the condensate flow. The latter is necessary for the gland steam condenser which requires full flow whenever vacuum is needed in the condenser, and turbine seals must be maintained. Standard carbon steel pipe is used throughout this system.

Second Cooling Cycle

The other cycle provides smaller quantities (3500 gpm) of cooling water for fan bearings, pump oil coolers, water-cooled doors on the steam generator, air compressor cylinders and coolers, intercoolers on the vacuum pumps, and the feed pump oil coolers and injection water cooler. Heat from this system is given up to the circulating water through a heat exchanger. Type K copper tubing is used for smaller lines to avoid any possible corrosion product buildup that might restrict flow.

Cleanup

During erection special care and inspections insured that all pipes were clean. In a number of instances this involved power brushing to remove rust or dirt that had accumulated during storage. Each section was inspected again prior to final fit up. All systems were flushed with water, and main and reheat steam lines were acid cleaned. The condensate feedwater cycle was both caustic and acid washed.

During cleanup of supercritical systems, water circulation through the main steam lines to the flash tank precedes the generation of steam. Main steam piping is flushed and steam cleaned in this manner initially and at each startup.

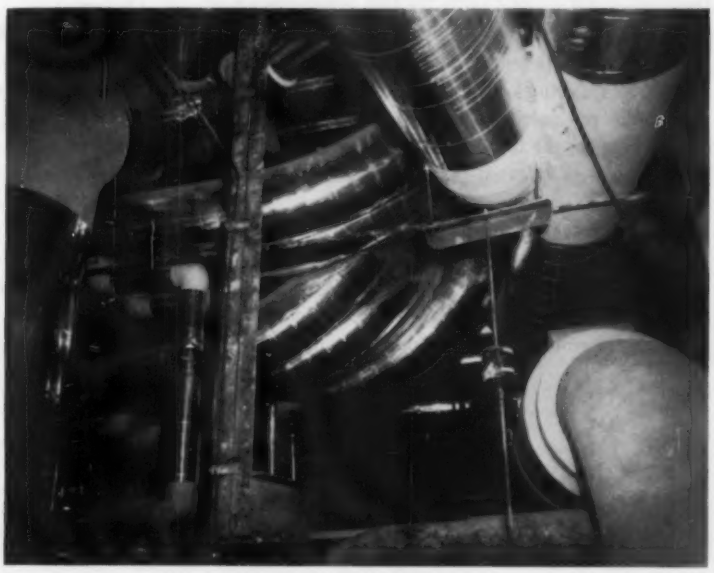
With maximum by-pass steam generation, the flash tank must provide a relatively large quantity of steam for pegging the deaerator and the top feed water heater, and this does not leave sufficient steam to blow the reheater systems with their large pipe sizes and tremendous volumes — a method used on subcritical installations.

Pipe Welding

Main steam, first reheat, and high pressure feed systems were welded using an inert arc root pass method, with consumable insert rings. All other welding was done by the metal arc process. Root and finish welds on the main steam and first reheat systems were inspected by gamma-ray.

4110 sections of pipe 2-½ in. diameter and larger were fabricated in economical lengths by Benjamin F. Shaw Co. Shop fabrication totalled 10.6 miles of carbon steel pipe (900 tons) and 4200 ft of alloy pipe weighing 368 tons. Field fabricated lines, in sizes 2 in. and smaller added another 10 miles.

Piping for Breed Unit No. 1 is not the biggest nor the longest in existence, but our aim was good design with reliability and economy, and this has been realized in good measure. ≠



PIPING beneath high pressure turbine illustrates close-quarter design problems where expansion is the critical clearance factor

This article is based on a paper presented at the recent American Power Conference

How to Certify the Safety of Direct-Use HTHW Heating Systems

By WILFRED H. COMTOIS, P.E.
Naval Reactors Division
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The increasing use of pressurized high and medium temperature hot water directly for high temperature-pressure radiation in occupied spaces gives rise to the question of what happens to tenants in the event of a leak. Many qualitative indications of space temperatures and pressures which can develop when leaks occur have been reported. Here for the first time is a procedure for calculating the space temperature-pressure conditions which will result.

The author has taken principles developed for protecting the public outside the containment shells of pressurized water nuclear reactors, and extended these to embrace the problem of protecting people who are inside a space heated with high temperature hot water.

THE USE of HTHW for comfort heating intensifies the problem of protecting those for whom comfort is being provided. A danger exists whenever energy is concentrated in small specific volumes, and becomes more pronounced as the concentration increases.

One immediate question is "What happens if a leak develops?" The answer to this question depends on three things: the leakage rate, the specific energy of the effluent, and the size of the room in which the leak occurs. The first is predictable only for an extreme case such as a complete pipe rupture, whereas the other two are fixed by design.

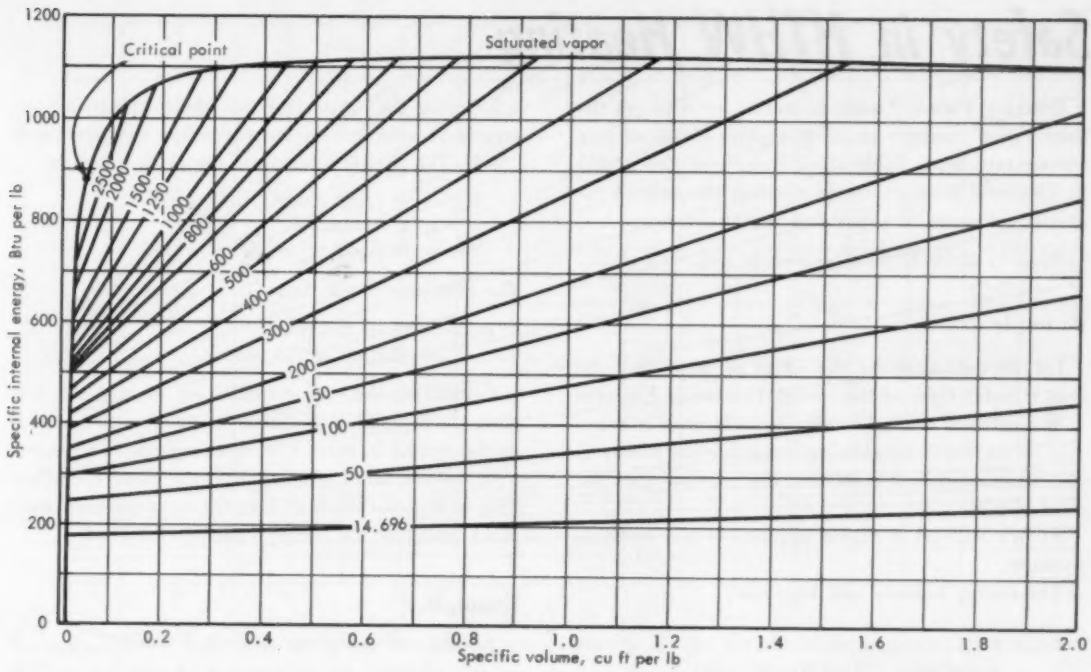
The general procedure used to calculate pressure and temperature resulting from a leak makes use of the familiar energy and mass balances plus an expression of constant volume.

In general terms, the energy balance is

$$w_2u_2 = w_1u_1 + \Sigma_i w_i h_i + Q_{heat\ transfer} \qquad (1)$$

where

w = mass, lb
u = specific internal energy, Btu per lb
h = enthalpy, Btu per lb
Q = energy loss, Btu
$(\ )_1$ = initial state
$(\ )_2$ = final state



1 HIGH PRESSURE RANGE specific internal energy, specific volume, partial pressure of water vapor (psia) relationships

The summation term includes all sources of fluid energy entering the system. The heat transfer term, Q, includes losses due to condensation and heating of other components of the system. The usual sign convention is used here wherein heat transfer to the system is taken as positive.

Mass Balance

The mass balance is simply

$$w_2 = w_1 + \Sigma w_i \qquad (2)$$

Again, the summation term takes into account all mass additions to the system.

The expression of constant volume is

$$w_2 v_2 = w_1 v_1 = V \text{ (Volume of the system)} \qquad (3)$$

Equations (1) and (2) are combined to give

$$u_2 = w_2 u_2 / w_2 \qquad (4)$$

and equations (2) and (3) yield

$$v_2 = V / w_2 \qquad (5)$$

Using the results of (4) and (5) to enter Figures 1, 2, or 3, one can immediately read out the resulting pressure.

Figures 1, 2, and 3 are essentially the same except for pressure range.

When To Use Method

There are three important provisions under which the foregoing method is valid:

a) Equilibrium is assumed.

b) The resultant system must be made up of one or two saturated phases of water.

c) The room or container considered is assumed to be rigid.

Example 1

To illustrate the use of this method, let us assume a room that is a 10 ft cube and which has in it a container holding 5 cu ft of water at 500 psia and 400 F. The room is considered to have rigid, adiabatic walls, and to define the boundaries of the system. Now consider what happens when the water container ruptures and instantaneously releases its contents into the room.

Neglecting heat transfer terms, Equation (1) reduces to

$$w_2 u_2 = w_1 u_1 \qquad \text{(Reference 1)} \qquad (6)$$
$$= 268.7 \times 373.6$$
$$= 100{,}386 \text{ Btu}$$

The mass balance is simply:

$$w_2 = w_1 \qquad (7)$$
$$= 268.7 \text{ lb}$$

Then we have

$$u_2 = w_2 u_2 / w_2 = 100{,}386/268.7$$
$$= 373.6 \text{ Btu per lb} \qquad (4)$$

and

$$v_2 = 1000/268.7 = 3.72 \text{ cu ft per lb} \qquad (5)$$

Entering Figure 2 with u_2 and v_2 we read out the final vapor pressure as 22 psia. The corresponding temperature from Table II of Reference (2) is 233 F. The total pressure in the room is the sum of the partial pressures of vapor and initial air:

$$P_{total} = 22 + 15 = 37 \text{ psia or } 22 \text{ psig.}$$

Example 2

Let us now evaluate the effect of neglecting the heat transfer term of the energy balance in Example 1. We will still neglect condensation for two reasons:

a) We are still considering instantaneous release of the compressed water so that there is no time for condensation.

b) We will get a liberal estimate of the resulting pressure.

The energy balance now becomes

$$\begin{aligned} w_2u_2 &= w_1u_1 - w_{air}c_v(T_2 - T_1) \qquad (8)\\ &= 100{,}386 - (75)(0.18)(233 - 70)\\ &= 100{,}386 - 2200\\ &= 98{,}186 \text{ Btu} \end{aligned}$$

as before

$$u_2 = 98{,}186/268.7 = 365 \text{ Btu per lb}$$

and

$$v_2 = 1000/268.7 = 3.72 \text{ cu ft per lb}$$

Entering Fig. 2 we find that the final vapor pressure is 21 psia and the corresponding temperature is 230 F. The partial pressure of the air is given by

$$\begin{aligned} P_{air} &= 15\,[(230 + 460)/(70 + 460)]\\ &= 15\ (690/530)\\ &= 19.5 \text{ psia} \end{aligned}$$

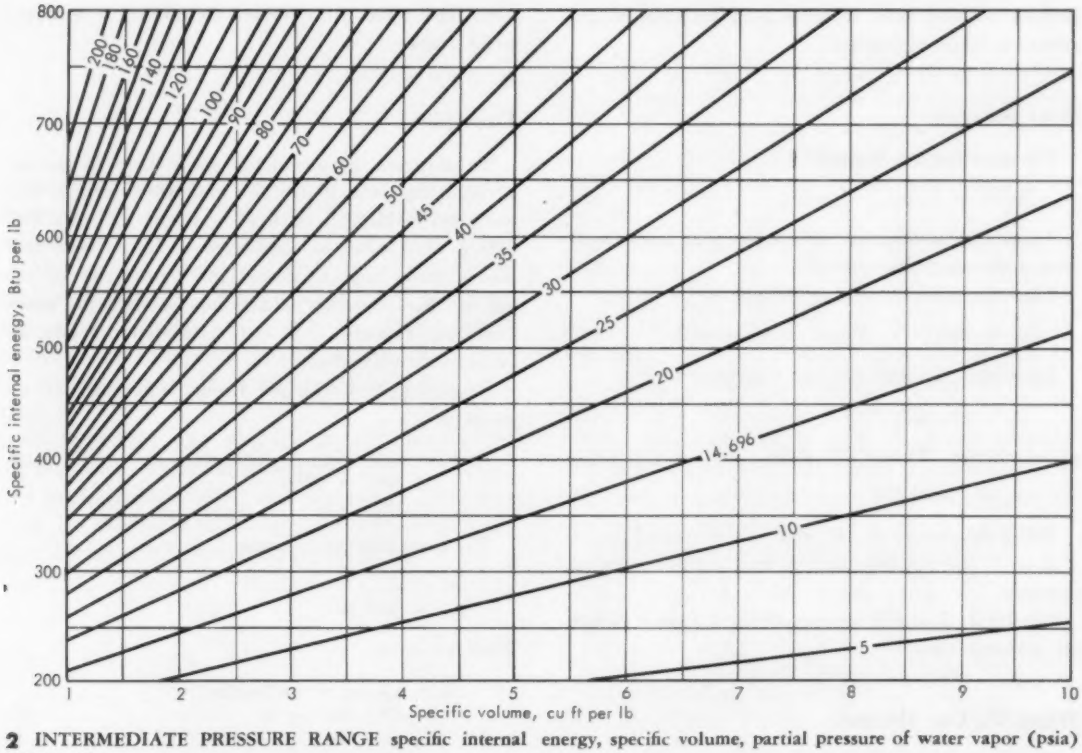
The total pressure is then

$$\begin{aligned} P_{total} &= 21 + 19.5\\ &= 40.5 \text{ psia or } 25.5 \text{ psig} \end{aligned}$$

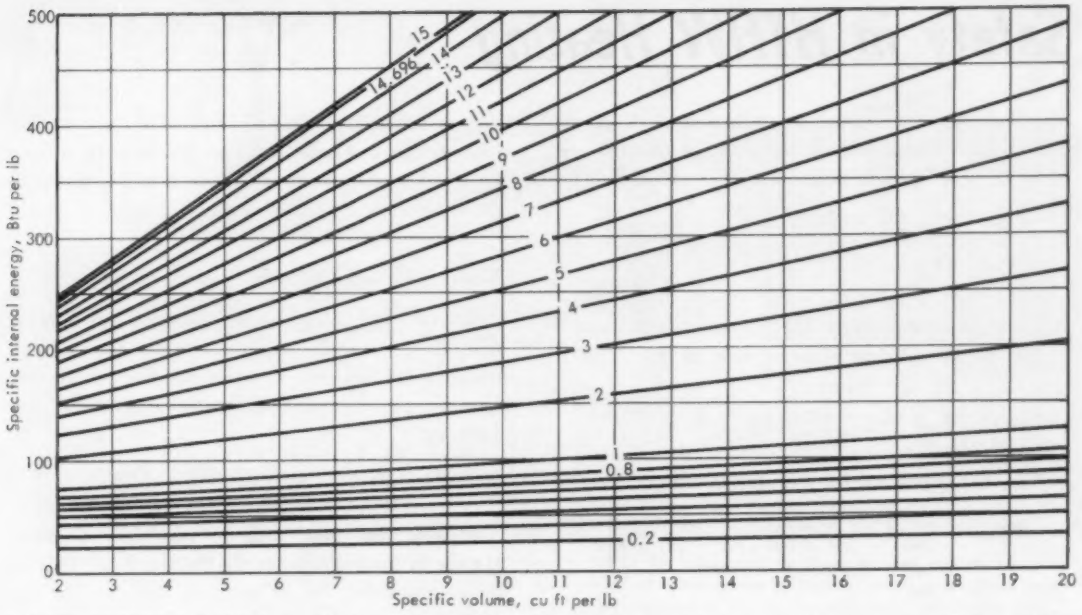
Comparing the two examples we see that the first gives the more liberal estimate of temperature, whereas the second is more liberal as regards to pressure, with neither solution much different from the other. This is because the heat transfer term does not have much effect on the energy balance (Equation 8).

Example 3

In order to study the effect that condensation has on this problem, let us repeat the foregoing example assuming a finite leakage rate. We will further assume that the container is outside the room and is connected by means of a pipe (this is done merely to keep our system volume at 1000 cu ft). The leakage rate will be assumed as 20 lb per second. We



2 INTERMEDIATE PRESSURE RANGE specific internal energy, specific volume, partial pressure of water vapor (psia) relationships



3 LOW PRESSURE RANGE specific internal energy, specific volume, partial pressure of water vapor (psia) relationships

will take 2-second time intervals and solve the energy and mass balances for each interval. For the first time step, the first term on the right hand side of Equation (1) vanishes.

1st time interval (2 seconds)

$$w_2u_2 = w_Lh_L\Delta\tau - w_{air}c_v\,(T_2 - T_1) - hA\Delta\tau\,[\tfrac{1}{2}\,(T_2 + T_1) - T_{wall}]$$
$$= 20 \times 375.3 \times 2 - 75 \times 0.18 \times (100 - 70) - 500 \times 600 \times (100 - 70) \times 2/3600$$
$$= 15{,}012 - 405 - 5000$$
$$= 9607 \text{ Btu}$$

$$w_2 = w_L \times 2$$
$$= 20 \times 2$$
$$= 40 \text{ lbs}$$

$$u_2 = 9607/40 = 240.2 \text{ Btu per lb}$$

$$v_2 = 1000/40 = 25 \text{ cu ft per lb}$$

where

$( )_L$ = leakage property
τ = time, and $\Delta\tau$ = increment of time
c_v = specific heat of air at constant volume, Btu per lb − F
T = temperature

Note that v_2 exceeds the range available in Figures 1, 2, or 3. There are two ways around this impasse. The first is to take a larger time interval for the first calculation. The second is to construct additional figures (see Appendix I for method).

Another difficulty is also possible if we examine the energy balance. If the leakage rate was 2 lb per second instead of 20, the energy balance would indicate negative energy. This usually means that a bad guess has been made for T_2 and a new try should be made. For "small" leakage rates (or "large" rooms) we would expect that the air and walls would absorb all the energy of the leaking fluid and the energy balance would give a zero result. Physically this means that the pressure rise is nil.

Repeating the first time interval calculation using a 10 second increment:

$$w_2u_2 = 20 \times 375.2 \times 10 - 75 \times 0.18\,(170 - 70) - 500 \times 600\,(120 - 70)\ 10/3600$$
$$= 75{,}040 - 1350 - 41{,}667$$
$$= 32{,}033 \text{ Btu}$$

$$w_2 = 20 \times 10 = 200 \text{ lb}$$

$$u_2 = 32{,}033/200 = 160.2 \text{ Btu per lb}$$

$$v_2 = 1000/200 = 5 \text{ cu ft per lb}$$

From Figure 3 we get P_2 (pressure) = 3.5 psia.

Continued on next page

Appendix I
Construction of the u-v Charts

The construction of Figures 1, 2, and 3 involves the use of the second table of Reference (2). For a chosen pressure and specific volume one calculates the quality (X) thus:

$$X = (v - v_f)/(v_{fg})$$

The internal energy corresponding to the chosen specific volume is then:

$$u = u_f + Xu_{fg}$$

Since lines of constant pressure are straight under the steam dome, Reference (3), one need only calculate two points per desired pressure line. One could choose internal energy first and then calculate the corresponding specific volume, but this is not recommended for accuracy.

Safety in HTHW Heating

The corresponding saturation temperature is about 147 F. This does not check the assumed temperature of 170 F for T_2. Reiterating with $T_2 = 158$ F:

$u_2 = 185.7$ Btu per lb
$v_2 = 5$ cu ft per lb
and $P_2 = 4.8$ psia
with $T_2 = 160$ F

which checks the assumed 158 F close enough.

For the second time step, we now have

$T_1 = 160$ F
$w_1u_1 = 20 \times 185.7 = 37{,}140$ Btu
$\Delta\tau = 2$ sec

The energy balance for this step becomes

$$w_2u_2 = 37{,}140 + 20 \times 375.2 \times 2 - 75 \times 0.18\ (160 - 160) - 500 \times 600\ (160 - 70)\ 2/3600$$
$$= 37{,}140 + 15{,}000 - 0 - 15{,}000$$
$$= 37{,}140$$

$w_2 = 200 + 40 = 240$
$u_2 = 37{,}140/240 = 154.8$ Btu per lb
$v_2 = 1000/240 = 4.167$ cu ft per lb

From which

$P_2 = 3.6$ psia
$T_2 = 149$ F

This latter temperature does not quite check the assumed value (160 F) and this time step should be reiterated. Assuming a final temperature of 150 F:

$P_2 = 3.7$ psia
$T_2 = 150$ F

Continuing in this manner we can calculate the entire pressure and temperature history. Note that the partial pressure of the heated air in the room must be added to obtain the total pressure at each step.

Procedure Can Be Refined

There are four places in the last example where further refinements can be made at the discretion of the analyst. First, note that the temperature of the walls was assumed constant. This is equivalent to assuming infinite thermal capacity for the walls. It may be desirable to assume finite capacity for the walls and calculate the new temperature of the walls at each step.

Peak Pressure Calculation

Secondly, in the example the highest pressure appears to be reached during the first time increment. If more detailed information is desired as to exactly when the peak pressure is reached, it will be necessary to use smaller time increments to start, in which case a figure similar to Fig. 3 but with a larger range of specific volume will need to be constructed as described in Appendix I.

Walls of Non-Uniform Temperature

Thirdly, one may not be content with assuming that all of the walls are at uniform temperature. To improve on this, one may rewrite the heat transfer term in the energy equation as a series of terms such as:

$$Q = h_1A_1\Delta\tau\ [\tfrac{1}{2}\ (T_1 + T_3) - T_{wall,1}] + h_2A_2\Delta\tau\ [\tfrac{1}{2}\ (T_1 + T_2) - T_{wall,2}] + \ldots$$

Finally, one may wish to take into account a change in the enthalpy of the leaking fluid. This may be accomplished by an analysis, utilizing the same method presented here, for calculating the pressure decrease in the container.

One additional note of caution in applying this analysis. The results are on a macroscopic scale, i.e., they will not say anything about pressure transients as a function of distance into the room. One can make a stab at this by considering only part of the volume of the room in the initial phases.

What Protection Is Available?

An examination of the energy equation (Equation 1) shows that for small leak rates, the heat transfer term becomes controlling. This fact suggests several things that can be done to limit pressure (and thereby also temperature) excursions:

1) Make the size of the room "large."

2) Limit total leakage by using automatic isolation valves which close upon sensing low system pressure or some other symptom of trouble such as high ambient temperature.

3) The same signal which is used to isolate supply HTHW could be used to turn on a sprinkler system. Introducing cold water as one the leaking fluids has a remarkable effect on the energy balance (Equation 1). ≠

References

1) Comtois, W. H., *Determination of Pressure in a Two-Phase System of Water*, Paper No. 56, Nuclear Engineering and Science Conference, 1960

2) Keenan, J. H., and Keyes, F. G., *Thermodynamic Properties of Steam*, John Wiley & Sons, Inc.

3) Keenan, J. H., *Thermodynamics*, John Wiley & Sons, Inc. p. 48

AUTO AGENCY consists of two buildings; main show room and office facility, foreground, with year 'round air conditioning by multi-zone unit, and two-part service building with attached waiting-display room, seen at extreme left. Service area uses gas fired infrared heaters to maintain comfort for workmen and customers, with roof ventilators to remove combustion products, wall louvers to supply outside air to space where doors are opened infrequently

Multi-Zone Unit, Infrared Heaters Provide Comfort for Auto Display and Service

By ANTON KRAPEK
Vice President
E. Roger Hewitt Associates, Inc.
Professional Engineers

LANSING, MICHIGAN, is the home of the Oldsmobile Division, General Motors Corp., and also of Story Olds, said to be the world's largest Oldsmobile dealership. To better serve a growing clientele, the owners of this agency recently elected to construct new showroom and service facilities.

From a great number of suggestions made by people close to the job and thus aware of the practical requirements, architects Freeman and Smith devised a two-building arrangement — one to house show room and office

MAIN SHOWROOM has extruded aluminum supply grilles around perimeter beneath glass walls with return ducts set into soffits around edges of luminous ceiling. Ducts were formed to follow angles of roof

Heating-cooling design meets the needs of showrooms and two kinds of service areas for car agency's new two-building facility

facilities, and the second to provide adequate service areas. The heating systems designed to accommodate the differing use requirements of the two buildings offer an interesting study in successful planning.

"Up-Front" Areas

The building which houses the auto display and administration spaces is generally square in shape, with an open court within to provide open air display effects. The show room part of the structure is single storied and L-shaped, with plate glass windows which extend from floor to ceiling. A folded plate roof covers the entire area. Bookkeeping, sales, billing, and executive office spaces occupy a two-story section of the building, with all mechanical and electrical equipment installed in the basement.

Year 'Round Comfort

The whole structure is fully air conditioned by means of a multizone unit with direct expansion cooling coil and hot water heating coil. A packaged fire tube gas fired Scotch boiler supplies hot water to the unit via a by-pass valve arrangement.

Of the five zones of control obtained from the unit, three serve the office areas while the remaining two supply conditioned air to the show room east-south and west-north walls, respectively.

Glass Poses Problem

Full-height glass walls in the showroom posed a problem of condensation prevention. For this reason, we suggested the use of floor grilles for air supply, with ceiling returns. With this in mind, we designed formed concrete under-floor ducts to extend around the display room perimeter. These were incorporated by the architects into the construction plans.

Extruded aluminum grilles are installed in a continuous strip for a neat appearance, and are blanked off except where duct openings occur. Multi-blade balancing dampers are used within each opening, and 2 in. thick polystyrene insulation is installed throughout the ducts.

Ceiling Return System

Return air ducts are concealed behind ceiling soffits at each exterior wall. Since the soffits lowered the ceiling height around the perimeter, this arrangement nicely accommodates a luminous ceiling installation. The combination affords two bonus advantages: a great deal of the heat from the lighting fixtures is removed by the cool return air during the summer months before it can affect room temperature; and during the winter continuous air circulation over the fixtures prevents excessive heat build-up. This should provide for a longer ballast life and lower maintenance costs.

Reverse Office Pattern

Air distribution within the office areas is opposite to that used for the show rooms. This more "conventional" arrangement supplies conditioned air through ceiling diffusers and returns it via floor grilles. About 25 percent outside air is mixed with return air at all times, and the exhaust systems are designed to remove a little less than this amount in order to provide a slight positive pressure within the building.

Infrared for Service Areas

The two-part service building is L-shaped, with one leg for major auto repair work and the other for a quick-service area plus an additional small show room. The juncture of the two legs is a two-story section, containing parts, locker, toilet and equipment facilities.

Walls in the quick-service wing are made up entirely of overhead doors installed side by side with just enough room between to provide column space. Customers drive into this wing, generally wait while the repair or service is accomplished, and then drive across the room and out through similar doors.

The heavy service area has only two overhead doors, since vehicles serviced here are spotted in one location and remain for a longer period of time.

Infrared heating is used in the service building. The owners imposed several requirements on the heating system design. These included a draft-free environment with warm floors and control that was "immediate."

Use Gas Fired Units

The flueless gas fired units installed provide all of these features, and more. Re-radiation from the floor means that service men working under hoists are comfortably heated. Vehicles that are wet with rain or snow are soon dry and easier to work on; similarly, auto washing is expedited. Floor temperatures are better than anticipated, and customers can stand close to open doors and be only slightly affected by cold air from the outside.

Reduce Original Setting

Initially, thermostats were set at 65 F, but have since been reset

to 55 F. It should be pointed out that the thermostats react to air temperature and do not read radiation effects. Even though air temperature is maintained at 55 F, occupants are more than satisfied with the comfort afforded by the infrared units.

Exhaust System

Since the heaters are of the flueless type, combustion products have to be evacuated. Each thermostat controls six units, and for each such bank of six a powered roof ventilator was installed.

When the thermostat in any one area calls for heat, it energizes electrically operated gas valves and also starts the ventilator for the group.

In the quick service area, where doors are frequently opened, combustion air is obtained by infiltration. Through-the-wall louvers are provided for heavy service space.

QUICK SERVICE facility, with continuous overhead doors on two sides is equipped with flueless gas fired infrared heaters. Each group of six heaters has roof ventilator to remove combustion products

Word of Caution

While the gas fired units used in this installation admirably suit the design allowances, it should be noted that caution should be exercised in selecting this type of heater for other space heating installations — as it is exercised, of course, in selecting any equipment for any job.

Manufacturers' recommendations must be strictly followed, especially regarding mounting heights, distances from building surfaces, and the proximity of combustible material to the heaters.

HEAVY SERVICE wing uses infrared heaters, with combustion air supplied through wall louvers visible at left

Additional System

The small show room which is part of the service building serves also as a waiting room and repair service billing department. Year 'round air conditioning is provided for this space by means of a separate self contained heating-cooling unit, with supply air delivered to the rooms through ceiling diffusers.

Architects for the project were Freeman and Smith, mechanical engineers were E. Roger Hewitt Associates, Inc., and the heating piping and air conditioning installation was by the R. L. Spitzley Co. All three firms have offices in Lansing. ⧺

Two Systems Change Climates In Unique Tropical Gardens

THIS IS the Climatron, a 24,000 sq ft aluminum and plexiglass hemisphere for tropical plants in the Missouri Botanical Garden, in St. Louis. To provide a close-to-natural environment for orchids, coffee and tea plants, jungle fruits and flowers, a unique heating and ventilating system in two parts was designed by Paul Londe, St. Louis consulting engineer.

The design problem was to achieve tropical and semi-tropical climates within the dome, with different temperatures and humidities in particular areas, and to vary these on a "night and day" basis.

The Climatron frame is a geodesic structure of tubular aluminum which rests on five bearing piers along the circular base ring. There are no interior supporting columns, nor any inside partitions. 4100 transparent triangles of 1/4 in. plastic, set in aluminum channels, are suspended from the frame as a "ceiling," but carry none of the load.

The interior is divided into two levels on the north-south axis, with the western half about 15 ft below the entrance level. A walkway extends around the inner perimeter on the upper level.

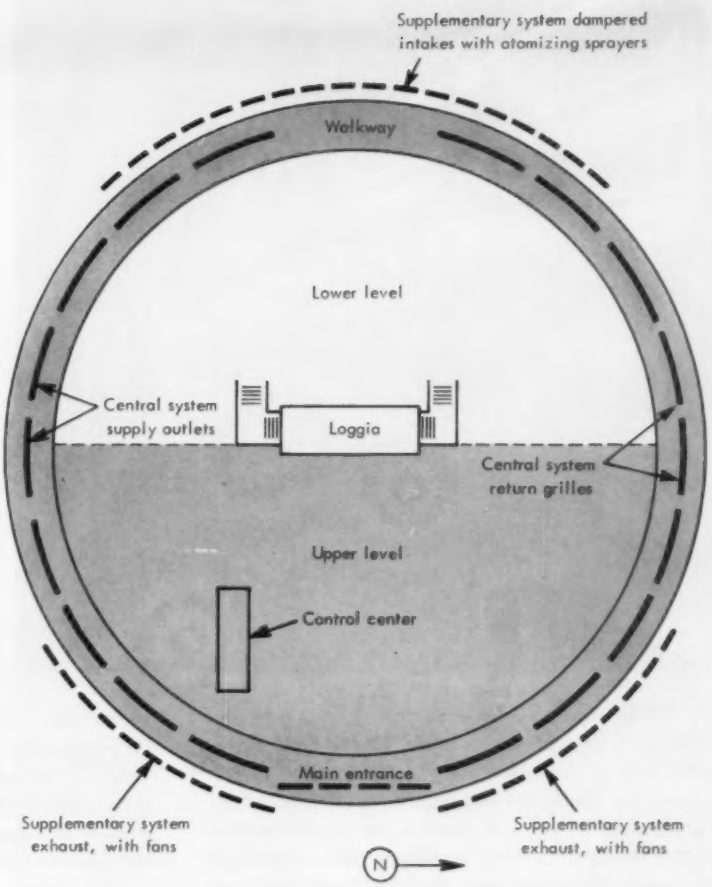
The two mechanical systems which provide varying climates within the dome are separated into two major functions; ventilation and evaporative cooling, and heating. The former results in air flow from west to east, while the heating system moves air from south to north.

Because the dome is transparent, solar heat gain during the summer months was a critical design factor. During the winter, however, St. Louis experiences sub-zero temperatures. Even under these conditions, and with no inside walls to aid in zoning, temperatures of from 60 to 90 F and relative humidities of from 50 to 100 percent can be maintained in each of the several zone areas at one time.

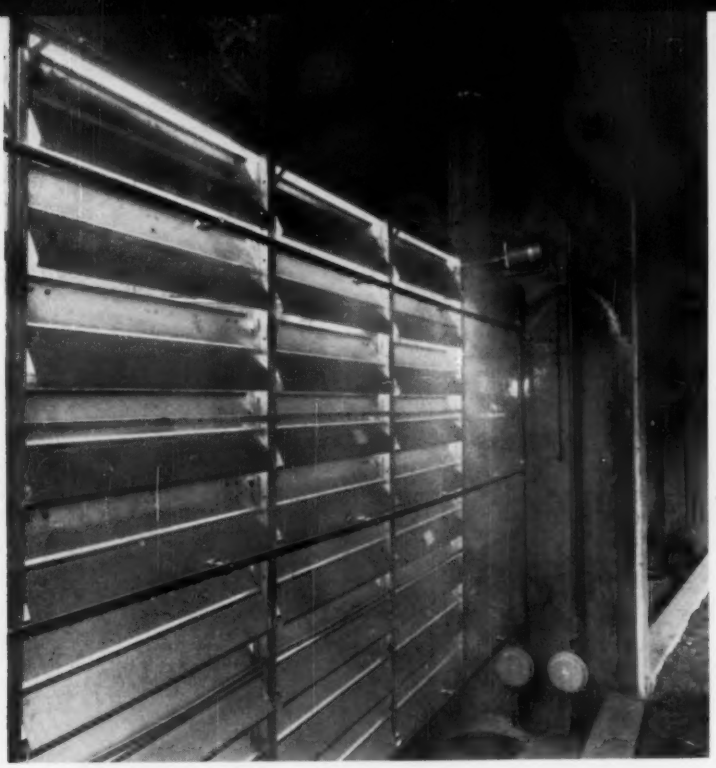
All mechanical equipment for the Climatron heating system is installed in a concrete bunker beneath the upper level. Steam is supplied from an existing boiler plant which also serves other buildings in the park.

Continued on next page

DRAWING at right shows approximate layout of two-directional heating, cooling, and ventilation installation. Shaded areas indicate upper level and continuous perimeter walkway. Loggia at the center of the garden is an arch and stairway retained from an earlier palm house in the park. The central system supplies heating and ventilating air via ducts beneath the upper level and walkway. Floor grilles are used on the high grade, and supply outlets for the lower level are installed in the same supply plenum, which extends beneath the perimeter walk. A similar arrangement is used for the return system on the north perimeter. The second system employs dampered intakes and water sprays located beneath the walkway on the west side. Eastside exhaust for this system is by a series of propeller fans. The following photos show some of the details of the two systems.



AIR SUPPLY for the two systems overlaps. Supply grilles in the plenum provide heating and ventilating air in generally south-to-north direction. Dampered intakes on the lower level are equipped with two types of water sprays to provide both evaporative cooling during hot weather and increased humidity when desired. General air movement for the latter system is from west to east. During the winter months, air returned through the grilles on the north perimeter is mixed with outside air to result in a predetermined air temperature at the fan inlets. It is then delivered through heating coils and steam spray humidifiers and through a tunnel passage from the north side to the south plenum.



AIR INTAKE for the second system is through a series of dampered openings, as shown here. These are located on the lower level beneath the perimeter walkway. The dampers are controlled by a thermostat in the entry air stream. Two types of water spray are available; the first, with fine spray nozzles, creates a fine mist which is absorbed by the entering air, and the second, with flooding nozzles, presents sheets of water through which the air must travel, thereby approaching more nearly complete saturation. Sprays emit either hot or cold water as required, aiding in proper humidification and furnishing heating or cooling effect during winter or summer months.

THE AIR entering the Climatron through the dampered water spray intakes shown above will be nearly saturated, and in the process of absorbing water the air temperature will be lowered. During the summer (at design conditions) this will result in an air temperature of 80 F DB, and a relative humidity of about 85 percent. As it passes across the space, the air will gain heat from solar radiation, conduction from the higher temperature plastic dome, and from equipment, people, and infiltration of outside air. While some moisture will be absorbed by the plants, overall, the air will show a net gain in absolute humidity.

As a result, air exhausted from the dome will be at a temperature of about 90 F and at 70 percent RH. A gradient of temperatures and humidities in the air path from west to east is thereby established.

This gradient occurs across the Climatron in about five paths. Intake dampers on the west end are constructed in three separately controlled sections. Air discharge is via five banks of individually controlled fans.

EXHAUST FANS on the east side of the circle complete the second of the two systems. The units are in two sizes, 5 and 6 ft diameter, to accommodate the changing slope of the structural frame. As described in the section above, these fans are divided into five banks. The effect of the two "opposing" systems is to create areas or zones of control within the dome with an infinitely variable air path pattern. The wide variation of temperatures and humidities within the zones is achieved by regulating the amount of outside air admitted to the two systems, and by the type of water spray through which the air passes.

CONTROL over both air distribution systems as well as over a variety of other services within the garden is exercised from the glassed-in control panel seen here. Its location near the main entrance to the dome is also shown on the plan diagram. Fans, dampers, steam valves and evaporative sprays are adjusted automatically to provide the required climate variation in the various areas. Day and night operations are initiated here to closely match the temperature and humidity changes of tropical regions. An override provision can maintain up to 11 hours of "day" conditions during the night-setting period when desired. Fans are either automatically or manually controlled, and each includes a recorder to total the hours of operation. Temperatures and humidities at 10 locations are also recorded automatically. The same panel controls lights, watering system, and special audio effects.

CONTROL POINTS in the Climatron include 10 thermostats and humidistats located at various spots. These function automatically through the control center to maintain preset conditions for growing the wide variety of plants and trees. The waterfall in the background is generated by a 150 gpm pump. Climate-producing systems in the dome have proved extremely flexible. Steeper temperature gradients for some future need can be obtained by adding mechanical refrigeration to the system, or by supplying chilled water through the air intake spray nozzles. Special filtering devices and catalytic burners are also contemplated for even greater flexibility in the air conditions supplied in the space. Present plans by the director of the park call for a series of smaller laboratories based on the Climatron design to simulate other climates for studying the effects of environmental changes on plants. Information for this article was supplied by the consulting engineers and by Minneapolis-Honeywell Regulator Co.

Architects: Murphy & Mackey, St. Louis
Garden Director: Dr. Frits Went
Photos by Jack Dennison

HPAC asks a plant engineer to comment from his practical experience —

Tips on Piping "Hard to Handle" Substances

By GEORGE F. WINTERSON
Plant Engineer
W. R. Grace & Co.
Dewey & Almy Chemical Div.

AT OUR new Owensboro, Ky. plant we formulate and treat various polyvinyl acetate emulsions and butadiene polymers used for adhesives, paints and other coatings, and other products. This requires a number of different piping systems handling a wide variety of substances which are considered difficult to pipe.

As in all such jobs, we have to strike a balance between initial costs, maintenance, and serviceability in our piping systems, so that eventually we can realize the greatest savings overall.

We have developed a number of practices with regard to the materials used and the methods of installation which may be helpful to engineers involved in the design and use of similar systems.

Briefly, then, these are some points we would recommend for piping systems handling the following specific substances.

Butadiene

We use flexible rubber hoses to transport butadiene from tank cars to the plant. This gives us great flexibility in spotting the cars. Permanent lines are of black iron. The flexible hoses are coated with polyvinyl alcohol, since any type of rubber will soften and swell under the solvent action of butadiene. Because of the coating, such hoses must be stored inside with the ends capped, since polyvinyl alcohol is water soluble and will pick up moisture from the air. Other than this simple preventive measure, there has been no need for special maintenance on the hoses. Plastic seats are used in the hose fittings.

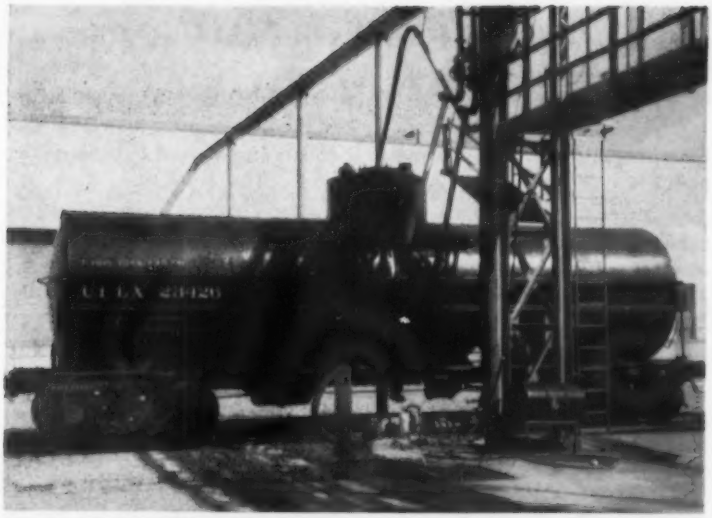
Organic Raw Materials

Black iron piping is used on permanent monomer lines. Because our catalysts and emulsions are quite sensitive to heavy metal contamination, a cleanup filter is installed in each line just prior to the reactor. The filters remove any specks of rust which might be present, and the lines between filters and reactors are of stainless steel.

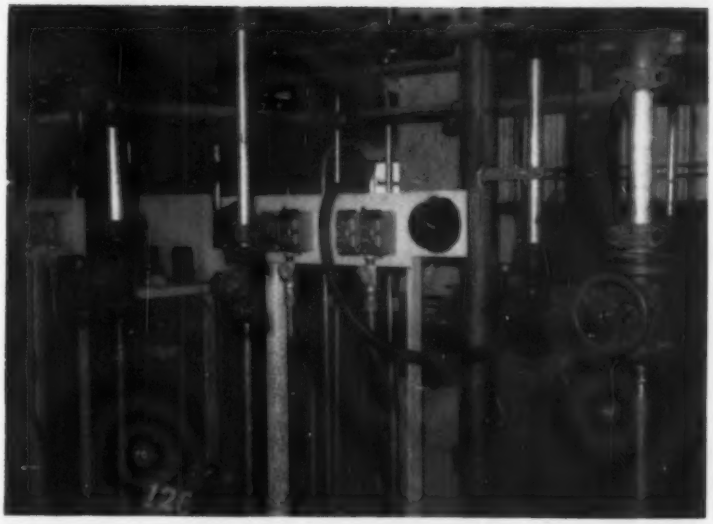
Latex

We have a variety of latices to handle, and they are piped as follows:

High viscosity polyvinyl acetate. Rigid polyethylene pipe is used. Assembly and disassembly of sections is quite easy with this material, and cleaning is simplified because the latex does not adhere readily to polyethylene. I feel this pipe gives excellent service as good as any material with the possible exception of glass which for other reasons we have not seen fit to install. Plastic



FLEXIBLE rubber hoses with swivel joints are used to transport butadiene from tank cars to plant



MAKEUP system is composed of aluminum piping with quick-release couplings

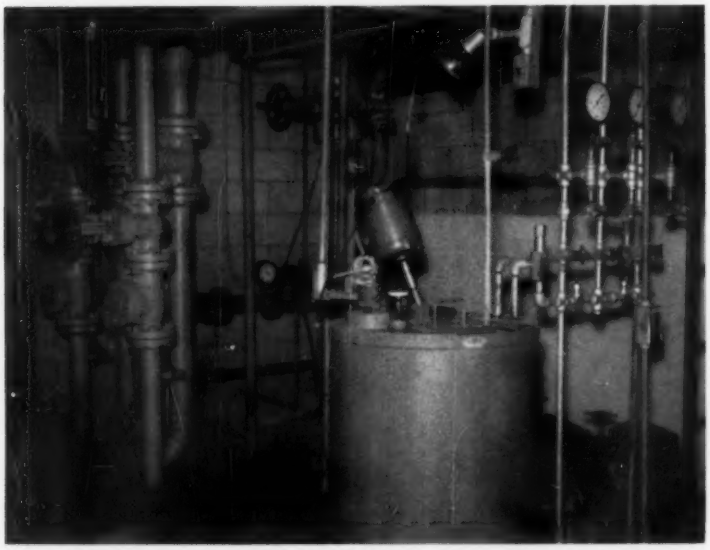
PRODUCT pipe of rigid polyethylene with diaphragm valves is used for high viscosity polyvinyl acetate handling

lined diaphragm valves are used throughout these lines, with little trouble except for some buildup at the constriction around the seat.

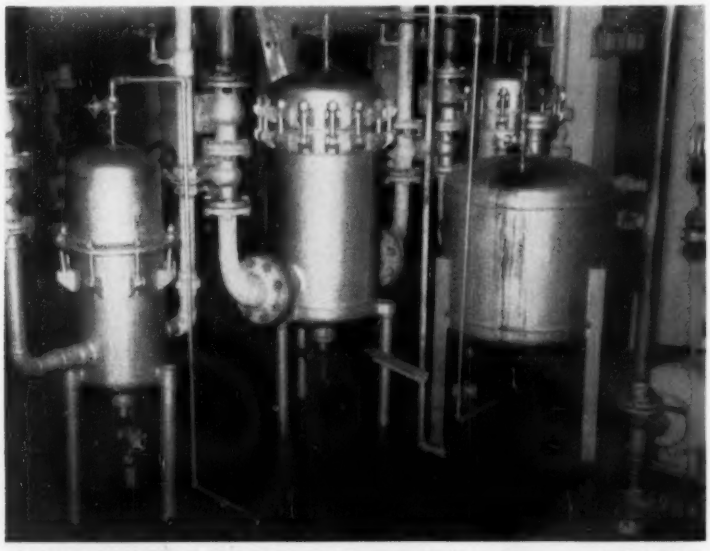
High viscosity polyvinyl alcohol. Since this substance is piped under high pressure, we use 3 in. aluminum pipe with detachable couplings for ease of installation and rearrangement. Aluminum pickup is negligible, apparently due to a fine film of polyvinyl which coats the inside of the pipe.

Low viscosity butadiene and styrene latex. Since a good deal of solid, gravel-like coagulum is formed during the manufacture of these latices, our piping consists of large reinforced flexible rubber hoses. The latex flows from the reactor bottoms through 4 in. stainless steel gate valves, through a filter and to a manifold. Coagulum is removed by the filter, allowing us to use plastic coated iron lines on the downstream side. These are easy to handle and provide long service.

Loading and special transfers of the latices are accomplished through flexible rubber hoses. Flexible fittings and swivel joints are used at several points in these special lines and have given good service.



DEIONIZED water system includes both aluminum and plastic-lined piping and valves. Water pH must be kept below 7.0



CLEANUP FILTERS installed in stainless steel lines allow use of black iron piping on upstream side

Hot Oil

All piping is stainless steel with flanged fittings. The 600 F oil is fed to a rotating drum in our process system, necessitating the use of rotary joints.

Water

Much of our process water is deionized, and must be maintained at a pH value of 7.0 with very low conductivity. Both aluminum and plastic-lined valves and pipe have been used with good results in this system. Glass piping, which we have not employed, would also give good service here.

In general, since our plant handles materials which present major plugging problems, we have designed (or redesigned during startup) our systems to include many breakpoints in the lines. Metal pipe is generally flanged very 20 ft, and plastic pipe is equipped with detachable couplings at more frequent intervals.

The cleanup filters have allowed us to economize to a considerable extent in the choice of materials by eliminating the need for a system constructed completely of stainless steel.

This applies mainly to raw material lines; stainless being a necessity throughout for our reaction vessels and lines.

Because of the danger of product discoloration, uncoated black iron pipe cannot be used on our finished products. However, we have minimized costs by piping finished product lines as described above. ≠

the law and your profits

JOHN F. MORRISSEY, author of this regular feature, is an attorney at law and has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Be Sure Your Signature Won't Make You Liable Instead of Your Company

AN INDIVIDUAL will often sign his name to a negotiable instrument without a true appreciation of the legal significance of his act.

There are several types of endorsements, but the most common is the type known as a "blank" endorsement; whereby a person who wishes to negotiate a bill of exchange, note, or check merely signs his name with no accompanying words.

In such a case the endorser becomes equally responsible with the original maker of the instrument for the promise of payment, to anyone who may subsequently take proper possession of it.

Officers of companies should know what legal meaning their endorsements of company-acquired instruments have.

The following case illustrates a problem that occurred where an officer of a contracting company endorsed and negotiated a promissory note.

Charley Smith was the treasurer of the Earley Heating Co., a corporation engaged in installing heating systems. Sometimes, after completing an installation, the company would accept a promissory note from the customer to cover a part of the installation cost.

The Earley Heating Co. purchased most of its equipment and materials from the ABC Furnace Co. The forms for making out promissory notes used by the Earley Co. were supplied by the ABC Furnace Co. When Earley's customers signed the notes, they were endorsed with the name Earley Heating Co., signed by Charley Smith, and delivered to ABC.

Subsequently, ABC negotiated one of the notes to a finance company, and when difficulty was experienced in collecting upon the note, Charley Smith found himself being sued.

Smith defended himself on the ground that he had endorsed the note not as an individual but as an agent for his company. He further claimed that an officer of ABC had fraudulently represented to him that his signature was required on the note only for identification purposes, and that he was not thereby making himself personally liable.

"I had no personal interest in the note," said Smith.

"Your testimony with regard to an alleged verbal understanding you had with an officer of ABC that you would assume no personal liability by your endorsement cannot be considered in this case." the court told Smith.

"Against a party to whom the note was later negotiated, such evidence is not admissible," said the court. "It is the law that a person placing his signature upon an instrument otherwise than as maker, drawer, or acceptor, is deemed to be an endorser, unless he clearly indicates by appropriate words his intention to be bound in some other capacity.

"Smith, who signed his name in the place of an endorser, was an endorser as a matter of law, there being no showing by appropriate words whereby he clearly indicated his intention to be bound in some other capacity, and oral evidence is not admissible to contradict the terms of the written contract between himself and a holder in due course."

Certainly the situation and decision would have been different if Smith had placed under the name of Earley Heating Co. the words "by Charley Smith, as Treasurer."

Such an endorsement would clearly have indicated that he was signing only as an agent and that he was not assuming personal liability. ≠

Survey shows common causes of motor failure . . .

How to Prolong Life, Improve Performance Of Heating System Electric Motors

By LEO KOWAL
Metals & Controls Inc.
A Corporate Division of
Texas Instruments, Inc.

HEATING SYSTEM breakdowns are of concern to a number of people — most immediately to the user, who must have heat, but also to those who design, install, and maintain such systems. It is to the advantage of all, obviously, to forestall as many failures as possible. Good design is the initial step, and includes a thorough knowledge of the equipment selected plus an understanding of the most probable cause of trouble, or the areas where difficulty is most likely.

Eventually, all mechanical parts must wear. It is the job of the maintenance engineer to insure that wear is kept to a minimum and consequently that equipment life is prolonged. Again, a thorough knowledge of possible trouble spots, coupled with a working preventive maintenance program, will get the most out of the equipment.

Anticipate Motor Trouble

One area of possible trouble is in the electric motors used for various purposes in heating systems. The purpose of this article is to make available some detailed information concerning motor failures in order that those involved can know what to expect.

This information has been accumulated during a continuing program of research in cooperation with several motor service shops throughout the eastern part of the United States. Survey representatives tabulated the repairs which were needed on almost 700 heating system motors as these units were taken down for service. The motors had been in service for varying periods of time, on oil burners, stokers, water circulators, and furnace blowers.

Table 1 details the repairs which were performed on these motors, and constitutes in effect a discrepancy check list.

It will be observed, of course, that there were many more repairs than motors. This is because all needed service was performed on each motor to restore it to top shape before it was re-installed in the system. The *immediate* cause of failure for the motors is not, therefore, always apparent. Rather the table serves as an indication of what was wrong, or going wrong, with the motors when the cumulative effect of wear, or one final part failure, finally forced removal of the unit from the system.

There is one exception to this. In those cases where windings had failed due to burnout or shorted or grounded conditions, that failure would be the most serious and would have caused the motor

TABLE 1 — DISCREPANCIES found in oil burner, stoker, water circulator, and furnace blower motors which had seen service switches, motor bearings, and windings, and means to prevent or postpone such failures, are discussed in text

		Repair classification**			Protector										Main winding only				Start winding only			
			Major																			
Motor type*	No. of Motors	Minor only	Burnout	Other	Heater burned out	Terminal burned	Tampered with	Shorted out or removed	Base cracked	Wrong rating	Improper connections	Foreign matter	Cycling complaint	Other	Burned	Shorted	Grounded	Open	Burned	Shorted	Grounded	Open
A	195	123	64	8												2			36	2		5
B	461	408	41	12	11	28	2		5	1	1	1	7	10				3	36	4	2	5
C	27	13	13	1				27	3			1					1		8		1	1
Totals	683	544	118	21	11	28	2	27	8	1	1	2	7	10		2	1	3	80	6	3	11

*A — no inherent protection; B — inherent protection; C — inherent protection by-passed

to stop in any event.

An analysis of the data in Table 1 reveals some pertinent conclusions regarding the kind and degree of wear on the various units, and we will next consider these discrepancies in order.

Start Switches

The highest number of repairs was required in the "start switch" category. This would be expected since this part gets more physical use than others. Constant starting and stopping causes switch contacts to open and close, and eventually, arcing caused by current going through the switch will erode the contacts until they either fail to make contact or become so pitted that they are in effect "welded closed."

On single phase motors, some motor shops may sand or file the single contact points on switches that have worn. Removing silver from the contacts in this way should be done solely as a temporary measure. Switch life will be considerably shortened, and replacement as soon as practicable is a must.

Motor Bearings

Again, as with start switch failures, normal wear accounts for a high number of motor failures due to bearing trouble. Lack of lubrication had caused many of the motors examined to become inoperative due to worn or loose bearings.

Maintenance personnel should note that bearing lubrication must not be overlooked when servicing heating equipment.

To insure extended bearing life, oiling should be carried out where possible every six months, and the motor tagged with the date of service. On larger motors, there may be a drain spout on the bottom of the bearing housing. The oil in this housing will become dirty and collect abrasive material in time, and at least once each year the old oil should be flushed out and new added.

On motors with sealed ball bearings, which are not accessible for relubrication, a close check should be maintained nonetheless. Engineers have developed a method of "listening" to motor bearings by placing a screwdriver on the bearing housing, with the handle pressed to the ear. This is effective, particularly with ball bearing motors, as it will enable the mechanic to hear "uneven" bearing noises.

Motor Burnouts

Motor failure due to winding burnout is not only a serious threat to heating operations, but represents additional hazards as well. Fire hazard from faulty windings is always present.

The highest percentage of burnouts (48.1 percent) in the motors examined occurred in those units where winding protection devices had been by-passed by maintenance personnel sometime earlier. This is a too-frequent practice in the best interests of no one. Sometimes the complaint will be that the motor is "cycling on overload" and the protector will be bypassed as a means of preventing that operation. Table 1 shows, again, that almost half of the motors which had been so treated had burned out.

Burnouts also took a high toll in motors without inherent protection — 32.8 percent. That failure was found much less frequently in motors equipped with built-in protection devices.

In the case of motor winding failures from shorted or grounded conditions, the difficulty is usually the result of damp or wet locations, abrasive material entering the windings, or exposure to corrosive acids and fumes. When units are to be returned to this kind of service, the motor shop should be instructed to give the windings two or three additional varnish dips and bakes. This will build a thicker protective covering over the winding for much better insulation.

Don't Ignore Cooling

Another point the maintenance man must remember is that motors require ventilation for proper operation. Therefore, anything that may block the ventilating air from cooling the motor should be removed, and the area surrounding the motor should be kept clean. This practice, and the steps necessary to insure that proper protective devices are installed and adequately maintained, can increase motor winding life substantially. ≠

in heating systems for varying time periods are itemized below. Failures in start

All windings			Rotor			Miscellaneous										
Burned	Shorted together	Open	Burned	Shorted	Open Soldered	Bearing	Start switch, governor, short circuit device	Reface and/or bore commutator	Brushes or holder	Shaft	Capacitor	Connections	End play	Leads	Inspection	Other
28			2	1		60	103	11	12	7	9	2	5	11	4	7
5	6		2		2	128	251	2	31	9	14	8	28	30	33	24
5					1	10	13		2		1					2
38	6		4	1	3	198	367	13	45	16	24	10	33	41	37	33

**Based on repair shop price estimates

• Water circuits in air conditioning systems are extremely susceptible to corrosive attack because of repeated aeration of the water and because of the variety of metals employed in equipment construction. The secondary effects of acidic gases scrubbed from the air in cooling towers, evaporative condensers, and air washers also tend to increase corrosion rates. Once-through, open, and closed water circuits are subject to corrosive attacks of different kinds and degree.

This article explores the various ways in which corrosion occurs in water circuits, and presents some interesting case history information obtained in various parts of the country.

How and Why Corrosion Occurs In Air Conditioning Water Circuits

By SIDNEY SUSSMAN
and
IRVING L. PORTNOY
Water Service Laboratories, Inc.

THE RAVAGES of corrosion have been brought into sharp focus in recent years as a by-product of the rapid growth of air conditioning. A tremendous increase in water requirements for air conditioning purposes has led to widespread water conservation regulations,[1] which have in turn forced the use of recirculation systems — with a resultant increase of water-caused troubles.

Although cooling water treatment has been a well recognized part of industrial water treatment for years, the generally smaller sizes and urban locations of air conditioning installations, together with the greatly increased ratio of recirculated to once-through systems, have made the comfort cooling applications more liable to certain water problems.[2-5]

The components of a typical air conditioning system are illustrated in Fig. 1. Of course absorption refrigeration could be substituted for the compression design shown here, but the water problems would be similar.

Three Areas Cause Trouble

In such a system, three areas may suffer corrosive action:

1) atmospheric corrosion of equipment and structural exteriors
2) refrigerant circuit corrosion, and
3) water circuit corrosion.

This article is concerned only with the problems of corrosion and its control in the water circuits. Reference 6 gives a general review of corrosion problems in all three areas.

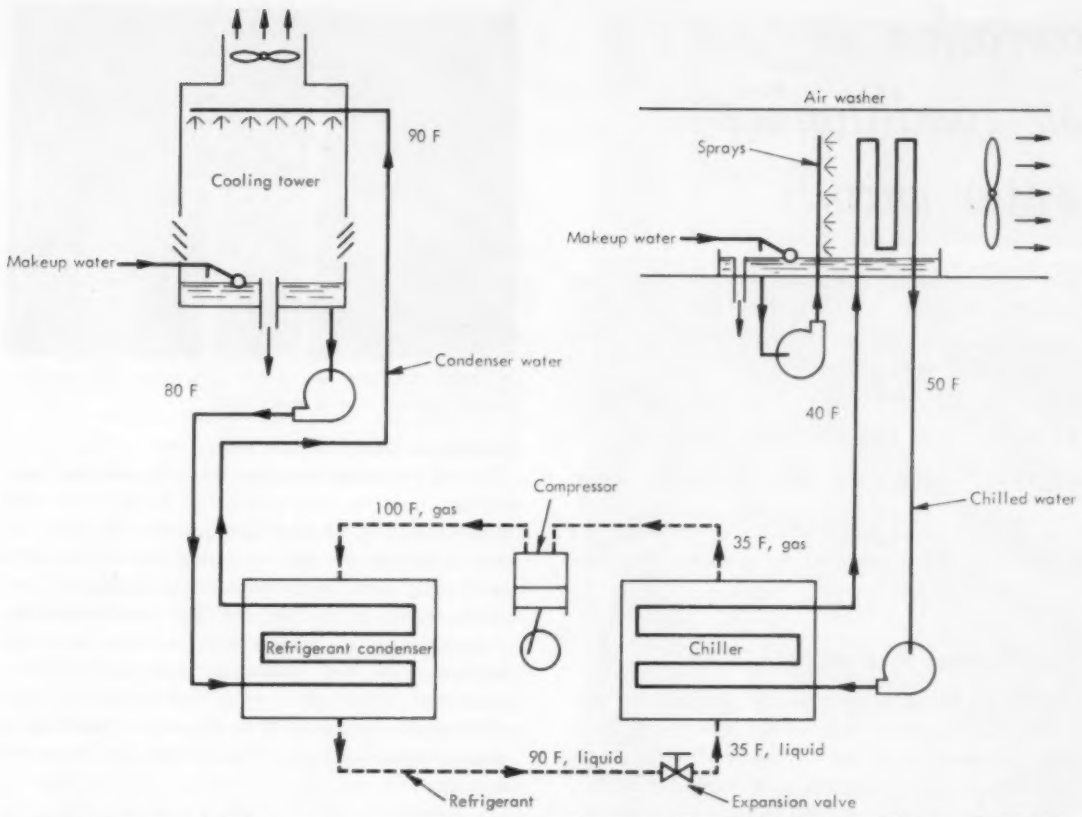
Three Factors Are Involved

The three foundation stones for supporting corrosion — water, metal, and oxygen — are inevitably present in virtually every air conditioning water circuit. Piping, heat exchangers, and other equipment are made largely of iron, copper, and brass. Water, of course, is the essential blood stream which circulates through the metallic veins of these systems. It is thoroughly aerated in the cooling tower, evaporative condenser, or air washer once during each pass through the equipment.

Outside Conditions Increase Susceptibility

In addition to these corrosion fundamentals, the typical air conditioning system provides many more conditions for intensifying the severity of corrosion. The vast majority of comfort cooling installations are made in urban areas where air pollution is usually high, particularly with regard to combustion

[1]*Numbers indicate references at end of article*



1 TYPICAL air conditioning system components for compression system, illustrated here, are subject to various kinds and degrees of corrosion, as discussed in text

gases such as sulfur oxides, and to solid particles.

Cooling towers, evaporative condensers, and air washers provide efficient air scrubbing so that airborne materials are readily transferred to the cooling water and, unless compensation is made, can develop aggressively low pH values in the water, along with wet poultices which promote severe localized corrosion.[7]

Size Is Contributing Factor

Further, because comfort air conditioning installations are generally smaller in size than industrial cooling installations, lighter metals are commonly used and corrosion failures may be more rapid under a given set of conditions. The smaller installations usually do not receive the same quality or degree of engineering attention in design and fabrication, and as a result many sound corrosion control precautions normally found in larger systems are omitted.

Finally, sound maintenance practices in some smaller systems may be either non-existent or carried out by untrained personnel.

The small average size and urban location of most air conditioning systems also mean that frequently selection of water treatment methods is based more

TABLE 1 — CORROSIVENESS of well and surface waters used for once-through cooling systems in selected areas is indicated below. All values except pH are in ppm. Total hardness, calcium, and alkalinity are reported as $CaCO_3$, others as the indicated constituent

Source	Wells					Surface
Location	Hicksville, N.Y.	Lynbrook, N.Y.	Plainview, N.Y.	Manasquan, N.J.	International Airport, NYC	Atlantic City, N.J.
pH	5.9	5.8	5.8	5.4	6.9	5.5
Total hardness	22	60	96	38	1490	14
Calcium	17	27	60	8	660	6
Total alkalinity	18	14	14	8	376	8
Free carbon dioxide	45	43	43	66	94	53
Chloride	7	20	10	12	2030	17
Sulfate	6	46	76	19	350	8
Silica	10	11.5	8	8	24.5	6
Total solids	42	124	157	59	4341	49

corrosion in air conditioning water circuits

upon mechanical or operational considerations than upon the chemistry of the problem. The same circumstances frequently make it difficult to maintain control of the chemical treatment given the water.

Types of Water Circuits

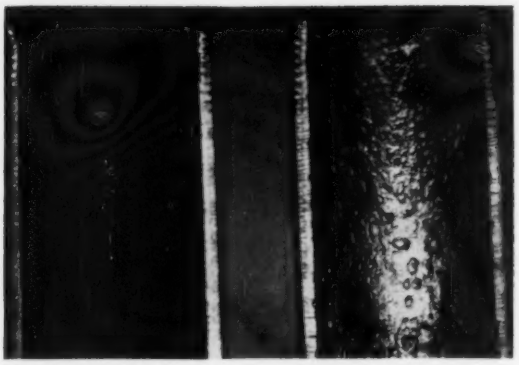
Air conditioning systems generally include one or more of three types of water circuits — once-through, recirculating (open), and closed recirculating. We will briefly consider some of the problems connected with each of these in turn.

Once-Through Systems

Water problems in once-through systems are identical to those found with similar water supplies in domestic situations. Many well water or surface water supplies are quite corrosive, as reflected in Table 1, and require proper material selection and/or corrosion control treatment. Fig. 2 shows a section of steel pipe which developed leaks after 30 months of service carrying well water in an air conditioning system.

Galvanized steel pipe carrying once-through cooling water from another well failed within three years. Analyses of the inlet and discharge water from this system showed a pickup of 0.2 ppm iron and 0.4 ppm copper as a result of corrosion of the equipment.

At a public utility site in a coastal location, it was assumed that a satisfactory quality of cooling water would be available because an ample supply of noncorrosive water was being obtained at an industrial



2 PIPE SECTION shown here developed leaks after 30 months' service in well water line

building a short distance away.

A well was completed after the equipment had been installed, and the water was then found to be both highly brackish and very high in carbon dioxide content. Although the copper piping which had been used might have been adequate for moderately corrosive water, at the planned flow rates there was serious danger of impingement corrosion occuring. Because of the large volume of water needed, treatment costs would have been so high that it was more economical to abandon the well, and to substitute a cooling tower using the soft, low-solids city water for makeup.

Volume Makes Cost Important

The large volume of water used in once-through cooling for even "small" systems makes the economics of water treatment important. It is usually necessary to compromise with effective corrosion inhibition in order to obtain acceptably low treatment costs.

About the only economic treatment methods available for corrosion control in once-through cooling waters are the addition of silicates, alkalis, or polyphosphates. Because of the size and location factors mentioned earlier, most comfort air conditioning systems do not lend themselves to lime feeding as a corrosion control method. Silicate treatment has

TABLE 2 — TYPICAL CASES from various locations indicating the characteristic occurence in cooling tower water of low pH, corrosion products, and significantly higher sulfate-to-chloride ratio than is present in makeup water at same locations

City	New York N.Y.		Pennsauken N.J.		Baltimore Md.		Springfield Mass.		Philadelphia Pa.		Lancaster Pa.		Richmond Va.	
Water*	M	CT	M	CT	M	CT	M	CT	M	CT	M	CT	M	CT
pH	6.9	2.8	6.9	4.9	7.7	3.2	6.8	4.4	7.0	3.9	7.1	4.3	8.3	4.1
Total Alk.	10	0	22	8	46	0	8	2	28	0	63	0	26	0
Free Acid.	0	28	0	0	0	120	0	0	0	5	0	2	0	1
Chlorides	3	81	4	53	4	116	2	15	16	355	11	931	17	610
Sulfates	8	960	15	610	14	1060	7	90	39	2250	40	3500	37	1820
Iron	0	84	0	13	0	28	0	0.5	0	39	0	250	0	53
Copper	0	3	0	3.2	0	1.4	0	25	0	180	0	0	0	4.5
Zinc	0	**	0	—	0	.25	0	0	0	—	0	0.1	0	trace

*M = makeup water; CT = circulating water in cooling tower
**Untreated circulating waters for new systems often contain very high zinc concentrations — 850 ppm in one sample

been used successfully for minimizing corrosion in systems utilizing the last two well waters listed in Table 1.

Open Circulating Systems

Evaporation of a portion of the circulating water takes place during the operation of cooling towers, evaporative condensers, and humidifying air washers. The resulting concentration of the dissolved solids causes scale formation to be the primary problem in this type of equipment over much of the country.

The thorough aeration of the water in such equipment frequently leads to some corrosion, but wherever a combination of moderately low alkalinity in the makeup and high sulfur dioxide content in the air occurs, unusually severe corrosive conditions develop.

Table 2 cites some typical cases, illustrating the characteristic occurrence in the cooling tower water of low pH, corrosion products, and a significantly higher sulfate-to-chloride ratio than is present in the makeup water.

Figs. 3 through 6 picture typical corrosion failures resulting from service in such corrosive, untreated circulating cooling waters. Many of these failures develop with spectacular rapidity. Leaks in copper condenser tubes within one air conditioning season are not unusual. In one southern New Jersey community, such a failure occurred in only three weeks.

Sometimes Cause Is "Local"

In some instances, these extremely corrosive conditions develop as a result of strictly "local" or immediate, conditions, such as thte unusually close proximity to the top of a smokestack, as in the Lancaster, Pa., example in Table 2.

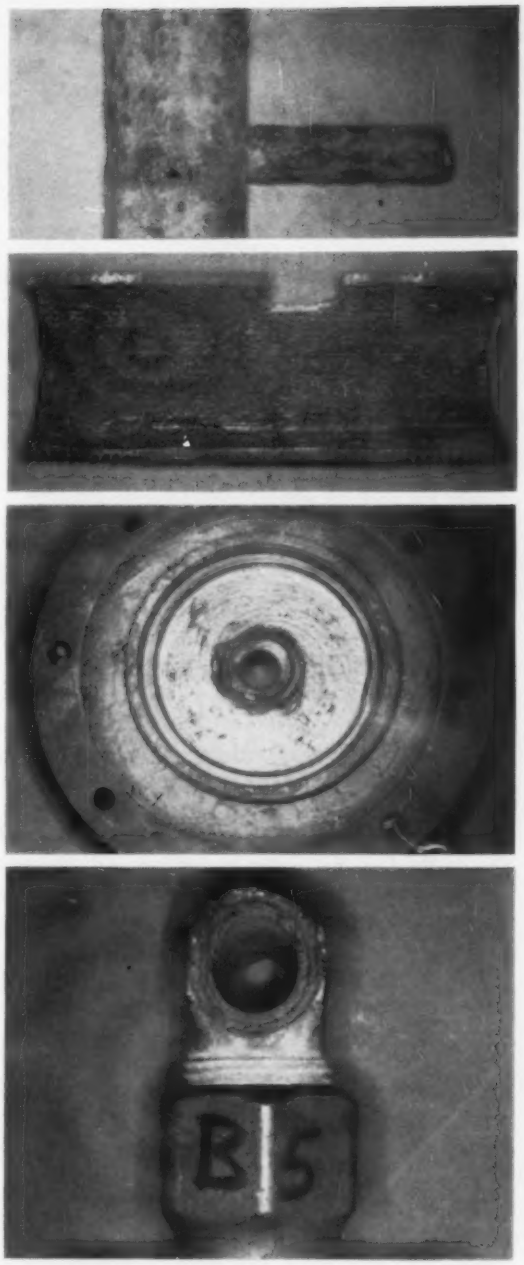
However, the occurrence of severely corrosive conditions in open circulating systems is surprisingly prevalent in some areas.

Table 3 lists the pH found in 1433 cooling tower samples, 74 evaporative condenser samples, and 37 air washer samples from untreated circulating water systems in the New York Metropolitan area.

Of these samples, 77 per cent had a pH below 7, 41 percent below pH 6, and 18 percent were below pH 5. Fig. 7 shows the pH distribution of the untreated water samples from cooling towers.

Operation, Construction Are Important

During the summer months, when air washers act as dehumidifiers, the water in them is being diluted continuously with condensate from the cooling coils. Regardless of makeup composition, the circulating water is then quite low in solids. Since it is scrubbing



3-6 CORROSION FAILURES in parts of open circulating systems

large volumes of air, this water is completely saturated with oxygen and is frequently of low pH because of absorbed carbon dioxide and sulfur dioxide. Fig 8 illustrates the corrosive damage brought about by such conditions.

The corrosiveness of a cooling water in an air conditioning system will, of course, depend upon the materials with which it comes into contact. Even with a circulating water which would not normally be considered very corrosive, serious attack can take

corrosion in air conditioning water circuits

place in some equipment. For example, in South Orange, N.J., a softened makeup water was used in an aluminum cooling tower. The normal concentration of the water and loss of carbon dioxide increased the pH from 8.3 in the softened makeup to 9.2 in the circulating water containing 13 concentrations of the makeup. This caused serious attack on the aluminum. Analysis of the circulating water showed the presence of 6 ppm of aluminum.

Ammonia Exhaust Causes Trouble

Another, less usual case was encountered in New York City, where the combination of extremely low makeup water alkalinity and high sulfur dioxide content of the air normally leads to low pH values in untreated circulating waters.

In this case, however, although there was considerable attack on copper components of the cooling water system, and copper was present in the circulating water, the pH was 7.1 and had not dropped despite the fact that water analysis showed evidence of appreciable sulfur dioxide pickup. Further analysis showed the presence of 51 ppm ammonia in the water.

It was later found that this ammonia was being picked up from a nearby exhaust system serving a photoprinting machine. The thoroughly aerated, ammoniacal cooling water was particularly aggressive toward copper condenser tubes, some of which had failed within three months. It also corroded ferrous metals. Fig. 9 shows a section of a cast iron condenser head from this system. The relatively high pH of the circulating water resulted in the deposit of unusually large amounts of corrosion products, and the cast iron was deeply graphitized.

Must Control Dissolved Solids

Even at much higher pH values than those mentioned, serious corrosion can take place in open circulating systems when, as so often happens in air conditioning equipment, no attempt is made to control the dissolved solids concentration.

Refrigerant condenser corrosion failures in each of two successive years in a Sarasota, Fla., building were traced to untreated circulating waters which had a pH of 9.1, but which contained about twice the dissolved solids concentration of a typical sea water.

Chromates Are Effective Inhibitors

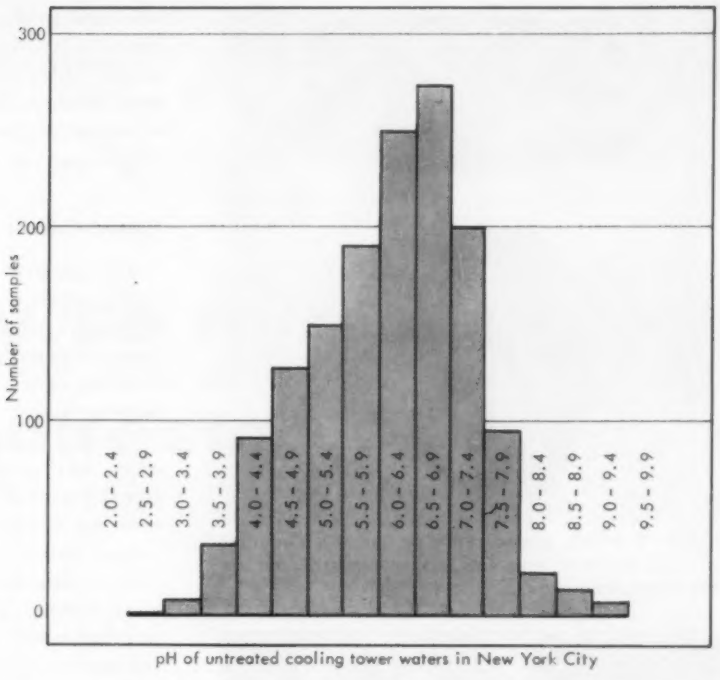
Minimizing corrosion in open circulating cooling water systems usually requires pH adjustment, generally to the 6.5 to 9.5 range, and provision for an inhibitor. Chromates are the most generally used and effective inhibitors for air conditioning equipment. They have proved effective under a wide variety of service conditions for protection of virtually all metals.[7-10]

Some measure of the degree of protection obtained by chromate treatment is reflected in Table 4, which compares corrosion rates measured with mild steel (SAE 1020) test coupons submerged in the pans of cooling towers, evaporative condensers, and air washers in the New York Metropolitan area. 52 such coupons suspended in untreated waters showed an average corrosion rate of 58 MDD, with individual specimens ranging from 15 MDD to 427 MDD.

In contrast, 75 coupons exposed in chromate-treated systems averaged 3.1 MDD, with a range of from no measurable corrosion to 9 MDD. J. F. Keville

	Number of Samples from				
pH	Cooling Towers	Evaporative Condensers	Air Washers	Total	Cumulative %
2.0 - 2.4	0	0	0	0	0
2.5 - 2.9	1	0	0	1	0.06
3.0 - 3.4	7	0	0	7	0.5
3.5 - 3.9	37	1	4	42	3.2
4.0 - 4.4	89	1	10	100	9.7
4.5 - 4.9	123	5	3	131	18.2
5.0 - 5.4	144	3	4	151	28.0
5.5 - 5.9	188	13	3	204	41.2
6.0 - 6.4	244	17	2	263	58.2
6.5 - 6.9	269	20	5	294	77.3
7.0 - 7.4	195	8	1	204	90.3
7.5 - 7.9	93	5	3	101	97.0
8.0 - 8.4	22	1	1	24	98.5
8.5 - 8.9	14	0	1	15	99.5
9.0 - 9.4	7	0	0	7	100
9.5 - 9.9	0	0	0	0	—
Total	1433	74	37	1544	

TABLE 3 — COOLING TOWER, evaporative condenser, and air washer samples in New York Metropolitan area showed following variation in pH values



7 TOTAL of 1433 cooling tower water samples in New York area yielded pH distribution shown here. All waters were untreated

and M. A. Scicchitano[11] have stated that the maximum acceptable corrosion rate for metals less than ¼ in. thick in such equipment is 0.004 in. of penetration per yr. This corresponds to 21.6 MDD for mild steel.

Nitrites May Be Substituted

Under some circumstances the yellow color of chromate solutions, or regulations on waste disposal, make it necessary to provide colorless or otherwise less offensive inhibitors. In general, the nitrites are the most common substitutes. However, recent work has disclosed that the inhibitor action of nitrites may be adversely affected by higher sulfate concentrations encountered in some cooling waters.[12]

Low concentrations of polyphosphates, polyphosphate-chromate mixtures and similar mixtures which are used for low cost corrosion control in large industrial cooling water systems are not as generally applicable for typical air conditioning requirements. Probably the most important reason for this is the fact that effective results require a rather narrow pH range on the low side.[13]

Because of the relatively high cost of pH controllers with relation to the total cost of the equipment, and the hazards of handling acids in urban buildings, control of pH within the required range is impractical for most air conditioning cooling waters.

In the past, proportional feeding of treatment chemicals has been generally too expensive for air conditioning installations. However, the rather recent development of relatively inexpensive feeder devices has made that method more practical.

Dirt Prevents Effective Treatment

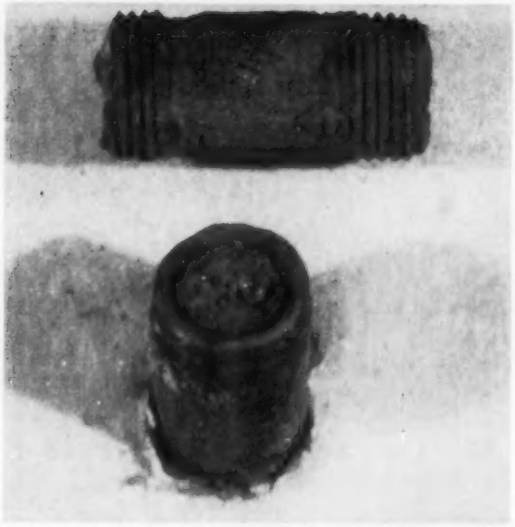
Corrosion inhibitors cannot be depended upon to protect those parts of the system upon which airborne dirt can settle and collect. Air pollution is so great in some areas that it is possible to accumulate a ½ to 1 in. depth of muck in the pans of cooling towers within a week. By preventing access of fresh, treated water to metal surfaces beneath the dirt layer, differential aeration cells are established and localized corrosion proceeds beneath the dirt. Under such circumstances, metal pans must be protected by paints or other protective coatings.

Algae Must Be Eliminated

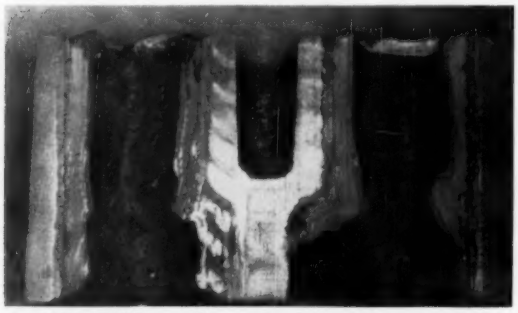
The control of slime and algae growths in open

TABLE 4 — CHROMATE TREATMENT affected corrosion rates on mild steel test coupons submerged in pans of cooling towers, evaporative condensers, and air washers in New York metropolitan area as indicated below

Days exposure	Circulating water treatment			
	None		Chromate	
	Samples	Aver. MDD	Samples	Aver. MDD
20 - 30	13	54	8	2.5
31 - 60	22	57	29	3.6
61 - 90	12	64	15	2.9
91 - 120	5	58	10	4.4
Over 120	—	—	13	1.8
Total	52	—	75	—
Average	—	58	—	3.1



8 AIR WASHER piping corrosion like this can occur under conditions of low-solids, oxygen saturated, and low pH summer operation



9 CAST IRON condenser head corrosion occurred in system invaded by ammonia vapors from industrial exhaust

circulating systems is of importance for avoiding localized corrosion which can develop beneath masses of slime or algae, as well as for minimizing interference with heat transfer.

Treatment methods most frequently used for this include chlorine and chlorine compounds, such as the hypochlorides, sodium pentachlorophenate, and certain quaternary ammonium compounds. Because of their common foam-causing tendencies, the latter must generally be used with effective anti-foams.

Mechanical Means Also Used

Relatively simple mechanical solutions can often assist in the protection of sensitive systems. Aluminum, for example, is particularly prone to pit in the presence of copper traces. Even chromate treatment will not provide 100 percent corrosion inhibition.

Therefore, in one system which included copper condenser tubes, extensive runs of ferrous piping, and a large aluminum cooling tower with aluminum piping, a 3 ft long sacrificial spool of 10 in. diameter aluminum piping was installed where the aluminum pipes connected with the ferrous pipes from the condenser. Although this spool was severely pitted in the areas closest to the iron piping, the remainder of the aluminum in the system showed no appreciable pitting during four years of service.

Closed Circulating Systems

The common picture of a closed chilled water system which requires virtually no makeup water is not always encountered in practice.[14] Instead, water losses at pump packing glands and other locations result in rather substantial makeup requirements in many cases.

Because of the relatively low temperatures at which such systems operate, scale formation rarely occurs even with substantial makeup, but corrosion is often a problem because of oxygen introduced with the new water.

Even when the damage does not lead immediately to equipment failure, clogging of strainer screens with suspended rust from corroded black iron piping can interfere seriously with normal operations.

The chromate inhibitor and pH control used in open circulating systems is also commonly used for corrosion control in closed circuits. Some operators will apply chromate treatment to a closed system which is known to be tight merely because the routine control analysis for chromate serves as an indicator of the development of water losses. ⊣

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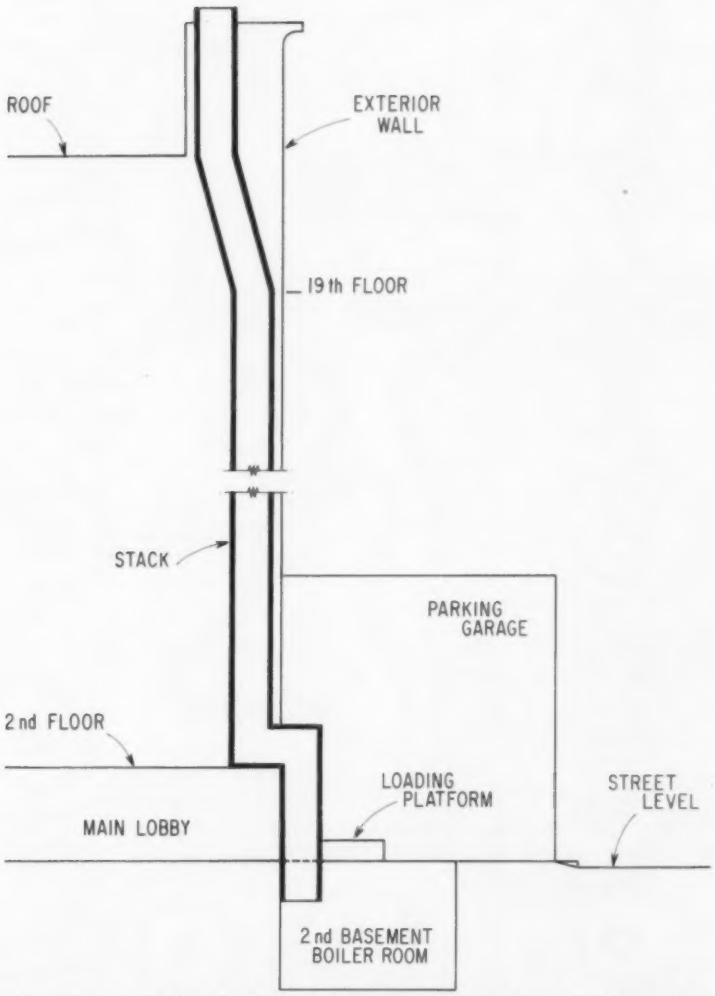
The stack for a new boiler plant is installed in unused corridor space in a 19-stor;· commercial office building —

How To Hide A Smokestack



ROUTING for boiler breeching and stack follows twisting path. Service floor on 19th level is 35 ft high

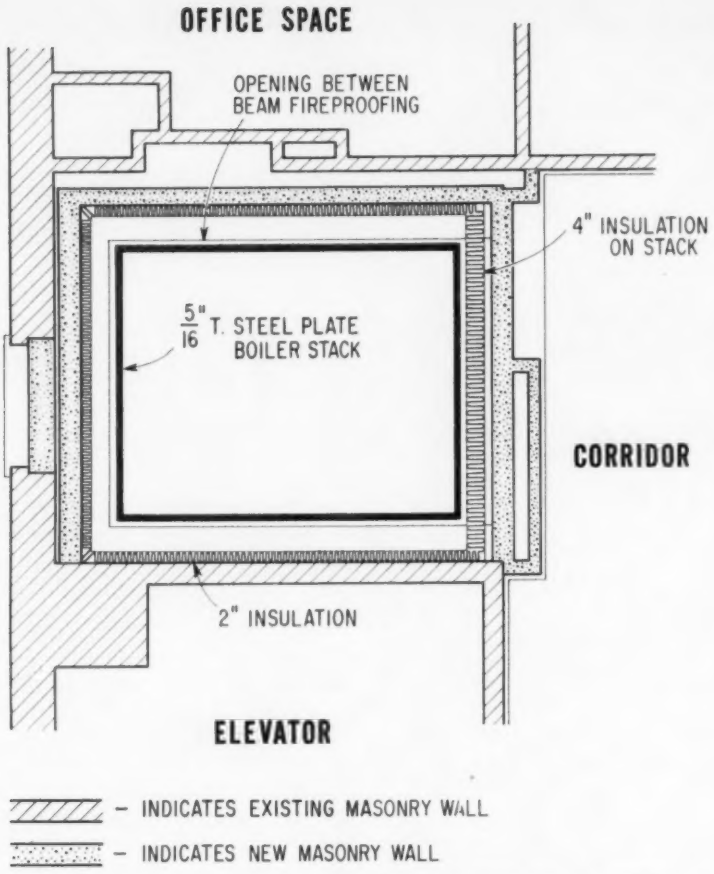
PROVIDING adequate venting for heating system combustion products in large in-town commercial structures can pose something of a problem — especially when owners wish to "hide" the stack for architectural or other reasons.

Here is an interesting solution worked out for a multi-building boiler plant in Newark, New Jersey.

Part of the Prudential Insurance Co. of America's building and redevelopment program at its Newark main office was the addition of a new boiler room facility beneath a new 6-story parking garage. Four boilers are installed to serve existing buildings and to provide for possible modernization in the downtown complex: three 50,000 lb of steam per hr packaged units, and a single 4500 lb per hr boiler for minimal service during the summer months. All are designed for oil firing, and the three main units also can be fired with gas.

Use Adjoining Building Space

The garage structure abuts the company's 19-story office building on one side, and when designers sought some means of concealing the necessary draft facilities for the boiler room, investigation



PLAN VIEW of stack enclosure reveals variety in insulation-air combinations used to fit space available. Insulation was applied to cavity walls on three sides, directly to stack on corridor side

showed that enough end-of-corridor space was available in the taller structure to house the shaftway and stack.

Routing for the boiler breechings was somewhat complicated by the need for avoiding the lobby area of the office building. The second-basement boiler room is located in one corner of the garage, next to the taller building. Breeching from the boilers leaves the boiler room at ceiling level and is then carried horizontally some 40 ft. before going up through a loading platform at the rear of the building. This vertical extension is enclosed with brick.

Enter On Third Floor

The stack enters the office building at the third-floor level. The space allotted to the shaftway from the third through the eighteenth floors is flanked on one side by an elevator shaft, and on the other by office areas. The outside wall forms the third side, and a new brick wall was laid in the corridors for the fourth.

How Heat Was Contained

An immediate problem which arose was that of preventing the transmission of intense stack heat to the interior of the building. In addition, heat loss from the stack had to be retarded in order to prevent the loss of sufficient draft, to prevent condensation on adjoining surfaces, and to maintain the temperature of the new corridor wall at a safe, touchable, level.

The anticipated flue gas temperatures at full, three-quarters, and one-third boiler capacity were 600, 530, and 500 F, respectively. To provide a safety margin, calcium silicate insulation for temperatures up to 1000 F was selected for the stack cavity.

Add New Shaft Walls

A masonry enclosure was laid up on the three existing sides of the shaftway to house the stack. The 5/16 in. thick steel breeching is roughly 7-½ ft wide by 5-½ ft deep. Since the enclosure is about 9 ft in width, the breeching left too little space for insulation to be applied after the steel was in place.

Consequently, the three sides of the shaft were insulated first. Toggle bolts were secured to the masonry walls on 12 in. centers, and holding wires attached to them. 1 by 3 ft, 2 in. thick insulation blocks were then secured in place by tying steel straps vertically against the insulation with the wire, after which all joints were sealed with asbestos cement.

Provide For Movement

The stack itself was then installed, with the fourth, or corridor, side, still open. Expansion and contraction is provided for even though the stack is welded to the building structural steel, by the use of 3 in. sliding lap expansion joints between the floors. Thus, each stack section is suspended independently.

Close Building Side

Insulation was applied directly to the stack on the remaining exposure. Pins were welded to the breeching, and to these wire lath was fastened, leaving 1 in. air space between lath and steel. Due to this smaller air space, 4 in. insulation blocks were used on this side. Blocks were fastened to the lath with wire, joints were sealed with cement, and the corridor

openings bricked up, completely enclosing the breeching.

Finished "Profile" Varies

Adequate insulating effect was achieved on the four sides of the shaftway even with the necessary variation in cross-sectional profile. To illustrate, the space on the four sides of the breeching, from the inside out, is used as follows:

Exterior wall side — 9 in. of air, 2 in. of insulation, 6 in. of masonry, 1 in. of air, and 1 ft of brick.

Elevator side — 9 in. of air, 2 in. of insulation, and 6 in. of masonry.

Office side — 9 in. of air, 2 in. of insulation, 4 in. of masonry, 4-½ in. air, and 4 in. of masonry finished with plaster.

Corridor side — 1 in. of air, 4 in. of insulation, 1 in. air, 6 in. of masonry, 4 in. air, and 3 in. of masonry with 1 in. thick marble wainscoating facing the corridor.

Outlet Is Also Hidden

The floor-to-floor height on each of the third through eighteenth floors is 13 ft, but on the top level, where building service equipment is housed, the distance is 35 ft. At this level the stack is inclined inward slightly to permit a tie-in with an 8 by 10 ft, 17 ft high rooftop stack which is set back 8 ft from the edge of the building behind a wall.

Allow 50 Percent Reserve

The new boiler facility has a capacity half again as large as the maximum anticipated steam requirement — 100,000 lb per hr at 125 psig. This will allow full operation even when one of the three boilers is shut down. The large size of the boilers (the biggest measure 11 by 30 ft) required that they be installed before the boiler room ceiling concrete was poured.

Various thicknesses of calcium silicate insulation were used for high pressure steam piping. Warm and cold air ducts in the boiler room and adjoining maintenance shops are insulated with glass fiber, covered with canvas.

August Arace & Sons, Inc., and H. W. Porter Co., Inc., both of Newark, were the heating and insulation contractors, respectively. ‡

The editors wish to acknowledge the cooperation of the National Insulation Manufacturers Association in supplying information for this article.

sam lewis says:

"The Contractor Should Certify The Inspection and Approval of Gas-Oil Burners"

THE heating, piping, and air conditioning system designer will be happier if when, wishing to maintain the lowest investment for his client and to reduce misunderstanding with the contractor, he includes certain special provisions in his specifications.

Here is a suggestion about damaged boiler encasements. The contractor who installs fuel burners for oil or gas, or oil burners that may be used alternatively for gas, shall, before placing the gas burning equipment in service, certify in writing to the owner that the apparatus for ignition and gas control has been inspected by and approved by the Gas Utility which will furnish the fuel, and by the boiler insurance company.

The cost of this inspection and the cost of any changes and additions needed to obtain approval shall be borne by the contractor.

Several costly explosions in new steam boiler plants have been traced to failure by the contractors to provide adequate controls for gas burning apparatus, and to failure in assuring the proper sequence of operation for such equipment.

The electric ignition of the pilot, the location of the pilot and its scanner within the combustion chamber, as well as the venting of air in the gas burner piping before opening the gas valves and automatic purging of the boiler heat transfer areas are all important.

In one explosion, solenoid operation of a valve failed. In another case, the vent outlet to the atmosphere was omitted. In yet another explosion the mechanical linkage between the pressure-sensitive device and the gas supply valve had knuckles with excessive end-play.

Explosion doors that may swing open to relieve the pressure of an ignition puff, inserted in the encasement of large package type boilers, have on two occasions during the past winter saved the owner the cost of rebuilding the boiler setting, and of un-bulging the steel jacket. ‡

How to Use Natural Gas As the Prime Energy Source For Air Conditioning

SPURRED by unbalanced winter and summer loads, and increased supplies of gas in many areas, the gas utilities are encouraging the use of natural gas to power refrigeration machines in air conditioning systems. Development and evolution of gas operated water chilling equipment has paralleled the growth of gas supply and has led to the availability of a wide variety of equipment. To take advantage of the competitive situation existing in the energy industries, the designer should be aware of the ways in which gas can be utilized.

Since gas is used to generate chilled water, no attention is given herein to end use equipment. Any one of the contemporary chilled water and air distribution systems may be used. Thus, consideration is given only to the application of natural gas to produce refrigeration effect and special considerations in applying the equipment.

How Gas Is Used

Gas may be used either directly or indirectly as the primary energy source for air conditioning. With *direct* use equipment, the combustion takes place within the refrigeration machine and the energy released by combustion operates the unit. In *indirect* systems, gas is employed to generate steam or hot water which in turn is used to generate chilled water.

Equipment for direct use of natural gas includes:

1) Direct-fired absorption systems.

2) Internal combustion engine driven compression systems.

3) Combustion gas turbine used either for driving centrifugal compressors or absorption machines with steam generated by exhaust gases.

Systems which employ natural gas indirectly are:

1) Steam and hot water operated absorption systems.

2) Steam turbine driven centrifugal compression systems.

At recent air conditioning schools sponsored by the American Gas Association, these various methods of employing gas were discussed in detail. Selected papers presented at these meetings are presented here in abstract. They provide much useful information for the designer and installer of gas operated air conditioning systems.

Absorption Refrigeration Systems

The following information on absorption refrigeration systems is based upon a talk given by P. E. Chamberlin, air conditioning engineer, The Gas Service Company.

Direct-fired absorption units are available in capacities up to 25 tons of refrigeration. The 25 ton unit is designed to provide both heating and cooling. Its heat input rate when producing chilled water approximates 22,500 Btu per ton-hr at rated capacity and condensing water temperature of 85 F. The same unit will provide 448 MBtu per hr of 170 F water for heating. Typical applications are in small commercial buildings though the multiple units have been installed to meet larger loads. Where required, a small booster-type heat exchanger can be utilized to increase heating capacity.

Absorption units, which may be operated by either steam or hot water, are manufactured in capacities ranging from 25 to 1000 tons of refrigeration. Steam pressures of 2 to 14 psig can be used to regenerate the refrigeration cycle but pressures of 10 to 12 psig are commonly used. Hot water at temperatures ranging from 240 to 380 F is suitable for absorption refrigeration machines. Heat input rate, assuming a boiler efficiency of 75 percent, approximates 27,000 Btu per ton-hr at full rated output.

Features of Absorption Units

The principal features of large absorption units listed by Mr. Chamberlin are:

1) Low pressure steam is used. Idle or excess summer boiler capacity may be utilized with increased boiler life expectancy a result. Hot water or other hot liquids may also be used by some units. The use of HTHW offers advantages in control flexibility.

2) Noise is minimized because there are no moving parts except for small solution pumps in the larger units.

3) Vibration free operation eliminates need for dampening and permits installation on any floor without added investment in foundations. This simplifies installation and permits a decrease in investment for structural support because of light weight.

4) Minimum maintenance cost and long life expectancy is assured by lack of moving parts in the refrigeration unit and stability of refrigeration solution.

5) Safety is assured through use of water as refrigerant, a simple non-toxic salt as the absorbent, and operation at sub-atmospheric pressures.

6) Freedom from damage by operating personnel is realized. Any overload can be presented to the machine without fear of damage. No vibration can occur on light loads.

7) Requires less floor area than is required for other machines of same capacity reducing investment chargeable to air-conditioning and increasing revenue producing space. Compact design makes unit readily adaptable to rigging, and roof top installations are common.

8) Operating flexibility is a maximum since refrigeration capacity modulates to meet varying loads by use of simple controls. The absorption machine will modulate from zero to full load. Part load efficiency equals or exceeds full load efficiency so steam consumption decreases with decreased load.

Application of large tonnage units varies with manufacture and for specific details, reference should be made to manufacturer's literature. However, some generalized application considerations can be given.

Cooling Tower and Condensing Water Piping

The cooling tower cost may be somewhat greater for the absorption machine than for comparable sizes of other equipment. For example, twice as much heat must be rejected with the absorption machine as with a compression system. This is because the absorption system must reject heat of refrigeration plus the heat of absorption. The compression system, on the other hand, rejects only heat of refrigeration and the heat equivalent of the shaft horsepower of the driver. However, the cost of towers for absorption systems may be only 25 to 35 percent greater if a larger tower frame size is required. This is because the condensing water temperature rise is 18 to 20 F with absorption machines as compared to 10 F for centrifugal compression systems making the tower more effective. In some instances, the same tower frame size may be required for either system.

Because of the higher heat rejection, a greater condensing water flow rate is necessary. Depending upon design circumstances, the increase in quantity will vary from a minimum of 10 percent to a maximum of 25 percent. Some additional cost in water pumping requirements will also result. Greater water losses due to evaporation, blow down, and drift must also be taken into account.

Steam and Hot Water Piping

Steam and water piping should be kept as simple as is practicable. Location of boilers and hot water generators in close proximity to the absorption machine is desirable to minimize initial cost. In new construction, steam boilers may be placed adjacent to the absorption machine, regardless of location within the building, to minimize the length of steam piping.

Electric Service

Wiring and electric service requirements for the absorption unit are small, for example, the maximum horsepower requirement (for solution, refrigerant and purge pumps) for a 700 ton absorption system is 14½ hp. The savings in first cost for wiring, service entrance, and transformers will tend to offset the higher first costs of the absorption unit.

Initial Cost

The initial cost of large tonnage absorption equipment is comparable with the initial cost of large centrifugal equipment when the two types are considered on an installed basis and there are no unusual items of installation affecting either system. For instance, if the steam or hot water piping to the absorption unit is unusually long or complex, the absorption unit may have the higher first cost. On the other hand, if the electric service entrance system is greater than normal, the motor driven centrifugal system may have the higher first cost.

Operating Costs

Operating cost must be treated in detail when comparing the economics of various system. One of

the principal factors influencing operating cost is the unit cost of energy to drive the refrigeration machine. This unit cost can be calculated from local gas rates, steam consumption, heating value, and boiler efficiency. For 1000 Btu per cu ft gas, and a boiler efficiency of 75 percent, a first approximation of operating cost per ton-hr for absorption machines is obtained by multiplying the cost of gas in cents per 1000 cu ft by 0.027. Thus, for gas at 60 cents per 1000 cu ft the cost is 0.027×60 or 1.62 cents per ton-hr. Other costs which must be considered in detailed cost analyses are the water costs (including water treatment) and the cost of operating auxiliaries such as solution, refrigerant, and purge pumps, tower fan and pumps, etc.

Other Application Considerations

In addition to the application considerations given by Mr. Chamberlin, some others should be noted. Among the points to consider in design and installation are:

1) Though vibration free, it is desirable to mount the absorption unit on rubber isolation pads when it is necessary to isolate the piping from the structure. When chilled water and condensing water pumps require vibration absorbing foundations, consideration should be given to preventing transmission of vibration through the absorption unit to the structure. Flexible piping connections should obviate the need for machine isolation in such cases.

2) Once the condensing water temperature is established, it is desirable to maintain it at a constant value. This is accomplished by mixing tower water and discharge water through a three-way control valve and tower by-pass.

3) Return of condensate is accomplished by means of conventional traps with condensate return atmospheric pressure.

4) Space should be provided to permit cleaning of the tubes.

5) Chilled water heads and piping systems should be insulated to prevent sweating. Chiller shell insulation is not required but may be provided if high ambient equipment room temperatures are expected.

Natural Gas Engines As Prime Movers

The following discussion of natural gas engines is based upon information presented by C. E. Hartwein, Laclede Gas Co.

Natural gas engines are not new, but it is only recently that the development of higher speed machines have made the use of this type of drive practical for operating air conditioning equipment. The industrial engine develops its maximum horsepower at speeds of 1200 to 2000 rpm. Natural gas engine driven packaged water chillers are available in capacities up to 150 tons of refrigeration and matched condensing unit-chiller combinations are available in capacities to 300 tons. Through the use of suitable drives, larger capacities can be achieved by using the gas engine to drive centrifugal refrigeration compressors.

Why Use Gas Engines?

Low operating cost is the basic reason for using gas engines to power air conditioning compressors. At present, an engine drive is the most economical and feasible means of converting gas energy into useful mechanical power. Equivalent heat input rates are approximately 13,000 Btu per ton-hr at rated capacity for large tonnage units — including power take-off for the condensing water pump — and for the average load per season, the engine will operate at 10,000 to 11,000 Btu per ton-hr.

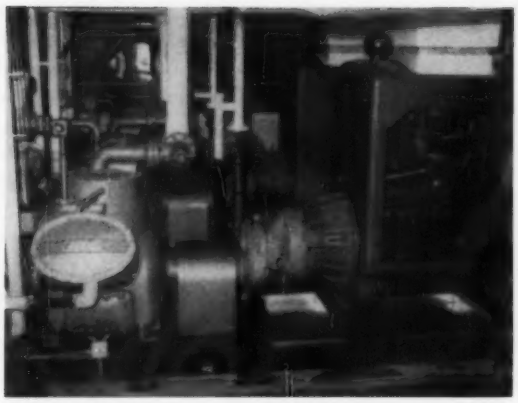
Installed cost compares favorably with other systems and where first costs are higher, the difference is generally offset by reduced operating costs. Since only a small starting motor is required, switch gear, transformers and heavy duty wiring are eliminated.

For gas with a heating value of 1000 Btu per cu ft, a first approximation of prime energy cost per ton-hr at full load can be obtained by multiplying the cost per 1000 cu ft by 0.013. Thus, for gas at 60 cents per 1000 cu ft, the cost per ton-hr is 60×0.013 or 0.78 cents per ton-hr.

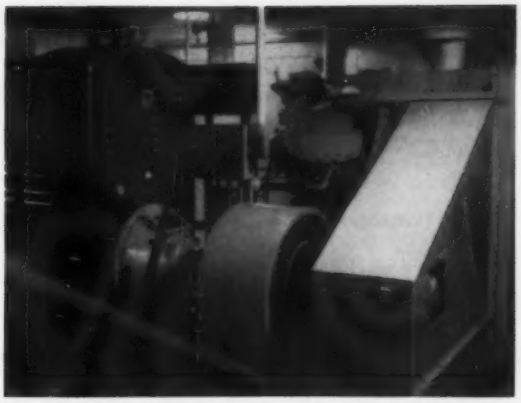
How About Noise?

The natural gas engine is quiet, but not as quiet as a small electric motor. However, it is usually quieter than the refrigeration equipment it drives. According to H. C. Hardy[1], the recommended loudness in sones for noise from heating and air conditioning equipment in offices varies from 1 sone in a conference room to 12 sones in a tabulating area. Extensive sampling of total loudness in sones for gas engine driven reciprocating compressors indicates the equipment will operate within these limits. Therefore, no extra consideration of noise need be made for all types of commercial installations, if commercial grade mufflers are installed per manufacturer's recommendations.

[1]Hardy, H. C., *Recommended Loudness Limits for Noise From Heating, Air Conditioning Equipment*, Heating, Piping & Air Conditioning, Vol. 31, No. 11 p. 129 (Nov. 1959).



GAS ENGINE driven reciprocating compressor shown here is direct connected through gear drive to engine. Gear drives require careful selection to minimize noise



DRIVE ARRANGEMENT shown here is indirect, using clutch, fluid coupling, and v-belt drive. Opened after 12,000 hr of operation, engines showed only slight wear

Flexible In Control

A well engineered engine driven air conditioning system can be made to operate at variable speeds according to demand instead of cycling on and off. The speed and capacity control of a natural gas engine is almost infinite and is very simple since only a control device operating the governor lever is needed. Capacity control is usually arranged to reduce engine speed to about one-half rated speed (about 1000 rpm) before unloading cylinders. Thus, the engine driven system can handle loads varying from 100 percent down to 10 percent without cycling. The engine will run at one-half rated speed about 70 percent of the season and at this speed the noise level of the compressor is greatly reduced. Reduced speeds, with resultant reduced power input, reduces fuel consumption. Reduced speeds also increase life expectancy of the engine and compressor.

Fully automatic controls can be applied to start and stop the units, thus, no attendants are necessary. Safety controls, in addition to those provided for the refrigeration system, should be provided to shut down the engine on low oil pressure or high water temperature. Hour meters should be provided to determine running hours. These are useful for scheduling maintenance.

How Much Maintenance?

Being a clean fuel already in a gaseous state, natural gas burns smoothly and does not leave carbon deposits. Complete combustion is obtainable in a natural gas engine and the engines operate at or near the ultimate CO_2 in the exhaust gas without producing carbon monoxide. Once the desired air-fuel ratio is adjusted, the air and gas mixer will maintain these conditions indefinitely.

Since natural gas burns clean, very little sludge is generated in the crankcase and fewer oil changes are required since there is no crankcase dilution. Natural gas lengthens engine life expectancy because of the above mentioned factors. Oil consumption can be decreased by equipping the crankcase with an oil temperature stabilizing coil. Reductions of oil temperature by as much as 40 F are obtained in this way in some available units. The same heat exchanger heats the engine oil during cold start-up.

Records show that the natural gas engine can operate, with reasonable care, from 15,000 to 30,000 hours between overhauls. Annual maintenance includes replacement of crankcase oil, spark plugs, ignition points, and general inspections. Since natural gas engines are mechanically similar to automotive engines, maintenance can be provided by good automotive mechanics.

Use Unloaded Start-up

The natural gas driven compressor should be started completely unloaded and remain at idle speed until all compressor cylinders are gradually loaded. At the time of start-up, the expansion valve is wide open. While the cylinders are gradually loaded, the expansion valve has an opportunity to gain full control of the refrigerant flow thereby eliminating slugging. This recommendation is equally important with electric motor driven compressors with modern unloading features.

Engine Cooling Increases Tower Size

A small heat exchanger of the shell and tube type, normally is installed on the packaged natural gas engine driven chillers for cooling the engine jacket water. A part of the cooling tower water is diverted through the heat exchanger for jacket cooling. Thus, a larger cooling tower will be required for the gas

engine than would be required for comparable electric driven compression systems. Tower-capacity is increased by about 25 percent. Since engine heat rejection varies with size, the exact heat rejection for a particular engine should be obtained from the manufacturer.

Other Considerations for Built-up Systems

In addition to the information provided by Mr. Hartwein, some other points, which apply to large built-up systems, should be noted. These are abstracted from an article by R. S. Curl[2] and R. C. Marsh. Among those that should be considered are:

1) Unless properly installed, vibration may arise in piping and foundations. Engine compressor arrangement foundations can be totally floated on vibration isolators. However, provision should be made for belt take-up if belt driven, and arrangement of engine coupling or gear box and compressor for proper alignment in direct driving operations. Steel bases on vibration isolators with minimum of mass foundation have been successful. Proper selection of the isolators for weight, frequency, and location is requisite for successful operation.

2) Either v-belt, gear box, or direct drive can be used, depending upon the speed, load, its location and application. Due to the possibility of harmonic vibrations, reciprocating engines should not drive reciprocating compressors of similar cylinder arrangement except through vibration absorbing devices like fluid couplings or belts. Direct gear drives, under certain conditions, cause considerable heat or objectionable harmonic vibrations. Careful engineering selection of the gear drive is highly recommended as a casually selected drive can produce more objectionable noise than either the engine or the compressor. Operation of rotary or radial type refrigeration compressors with reciprocating engines have produced no harmonic vibrations.

3) Consumption of engine oil occurs under certain operating conditions. To minimize the need for addition of oil, a large oil reservoir or auxiliary oil tank is provided on packaged units. An automatic oil feeding device and oil supply should be provided on built-up systems when it is desired to minimize maintenance requirements.

4) The exhaust system which carries the hot combustion gases out of the building consists of exhaust piping, mufflers (either normal or water cooled), and, in most cases, flexible connections in the exhaust pipe between the engine and the exhaust piping to the outside. If exhaust pipe temperatures reach 1000 to 1200 F, the exhaust system should be properly insulated or shielded for fire protection and to prevent abnormal heat radiation. Excessive heat can be removed by placing the muffler and exhaust pipe in the ventilation duct to the engine. Ventilation of the engine to remove radiated heat from the equipment room should be given design attention. Since approximately 3 percent of the fuel input to the engine is lost by radiation, it is recommended that jackets enclose the engine to reduce the heat transfer to the equipment room. This will also reduce the noise level.

Steam Turbine Drives

The following information on the application of steam turbine drives is abstracted from a paper by J. C. Conrad, centrifugal sales manager, Worthington Corp.

The primary type of refrigeration system which utilizes the steam turbine for motive power is the centrifugal refrigeration system. One of the basic reasons for the particular compatability of the centrifugal compressor and steam turbine driver is operating speed. Centrifugal compressor speeds will vary from approximately 3000 rpm in the larger size machines to about 10,000 - 12,000 rpm in smaller sizes. The steam turbine is also basically a high-speed machine, in general attaining better efficiencies and, therefore, lower steam consumption rates as speeds increase. This makes it an ideal companion for the centrifugal compressor, the two being directly connected without any intervening speed-compensating devices. As a result, important reductions in both space requirements and noise levels are made possible. A minor advantage also lies in elimination of the approximately 2 percent horsepower penalty found in the use of gear speed increasers.

Provide Vibration Isolation

The entire assembly, consisting of compressor, turbine, and heat exchange equipment, is usually mounted on an integral concrete foundation. However, certain installations, such as on upper floors of buildings where reduction of weight is a factor, dictate the use of a structural steel base. Such a base must be designed to assure a maximum rigidity to prevent misalignment of rotating parts.

The near-absence of vibration-creating components allows the assembly to be mounted with a minimum of vibration absorption treatment. With a concrete

[2]Curl, R. S. and Marsh, R. C., *Gas Engines Drive Air Conditioning Systems*, Heating, Piping & Air Conditioning, Vol. 30, No. 9, p. 144 (Sept. 1958).

foundation, the usual treatment consists of providing a 2 in. layer of cork under the machine pad. If the pad is depressed so as to be flush with the machine room floor, a peripheral band of cork is installed as well. Under very critical upper-floor installations, the use of spring-type vibration absorbers is sometimes dictated.

What Operating Pressures?

The majority of turbine-driven centrifugals operate at steam pressures ranging from 100 psig to 250 psig. Almost without exception, these turbines operate on a condensing cycle, exhausting steam to water-cooled condensers at vacuums of 25 to 28 in. of mercury. Only a relatively few plants, principally in the industrial classification, provide steam to the turbines at higher pressures, ranging up to 500 psig. In many cases, these plants also have need for steam at reduced pressures, so that the turbine finds supplemental use of an efficient pressure reduction device, either exhausting at a desired back pressure or having one or more steam extraction outlets.

Since the majority of turbine-driven centrifugals for air conditioning operate at medium steam pressures, the need for steam condensers is obvious from an operating economy standpoint. The typical refrigerant condenser utilizes approximately 3 gpm per ton of cooling tower water at, say, 85 F inlet temperature. Under these conditions, the water temperature rise at design load is 10 F. This water, leaving the refrigerant condenser at 95 F, is commonly circulated through the steam condenser before returning to the cooling tower. Here a second rise of 10 F in water temperature is usual. Thus, maximum usage of the tower water is made, requiring that the tower be designed to cool 3 gpm of water through a range of 20 F for every ton of refrigeration capacity.

What Type Of Turbine?

The type of steam turbine selected to drive a centrifugal compressor is dependent upon a number of factors.

Is a low steam rate of prime importance? This is more often than not the case, due to cost of utilities, lack of any excess boiler capacity, maintenance of desired plant heat balance, or other reasons. The usual choice to meet this requirement is a multistage turbine, operating on a condensing cycle. Typical steam rates for this type of turbine vary from about 16 lb per brake horsepower (bhp) per hr with inlet steam at 125 psig., to about 12 lb per bhp per hr with 250 psig steam.

The table below shows the effect on initial system cost of providing a better-than-average steam rate. The base rate is taken as being a steam consumption of 16.5 lbs per hr per ton of refrigeration effect. Also indicated is the slightly higher cost of providing comparable performance with refrigerant-12, due to its somewhat poorer cycle efficiency.

Effect of improved steam rate on initial cost of a 500 ton system (100 psig steam supply, 26 in vacuum)

Refrigerant	Steam rate lbs per ton per hr		
	16.5	15.5	14.5
R-11	100.0%	102.2%	106.7%
R-12	104.4%	107.7%	113.3%

Is there a need for low pressure steam elsewhere in the plant or building? If so, this need may be met by one of two alternatives. The driving turbine may either be of the extraction or of the back pressure type. An extraction turbine exhausts normally at a vacuum for minimum steam rate, but has one or more ports at intermediate casing points through which low pressure steam may be withdrawn for specific purposes. The back pressure turbine, as its name implies, exhausts at some above-atmospheric pressure, and as a result has a much higher steam rate. Typical requirements for low pressure steam would be for water heating, hospital sterilizing needs, industrial processes, or chemical refrigeration systems. In any case, the driving turbine serves as an efficient means of reducing steam pressure while simultaneously performing useful work.

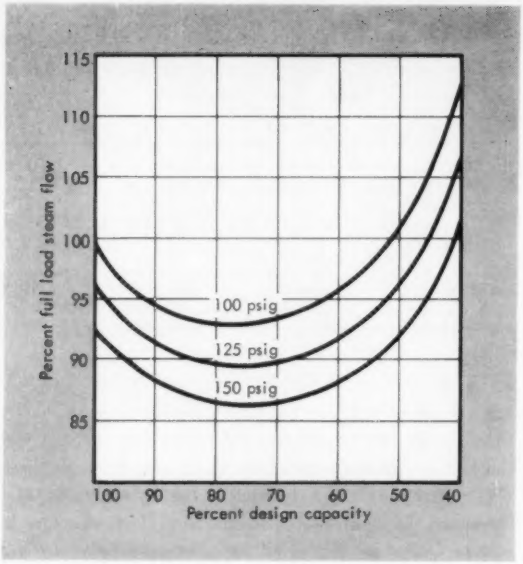
What Effects Steam Rate?

Turbine steam consumption is dependent upon a number of factors. The design of the turbine is, of course, a principal one. Another is the effect of initial steam pressure and exhaust pressure. The greater the difference between inlet and exhaust pressures, whether by increasing the supply steam pressure or reducing the exhaust pressure, or both, the more favorable is the resultant steam rate.

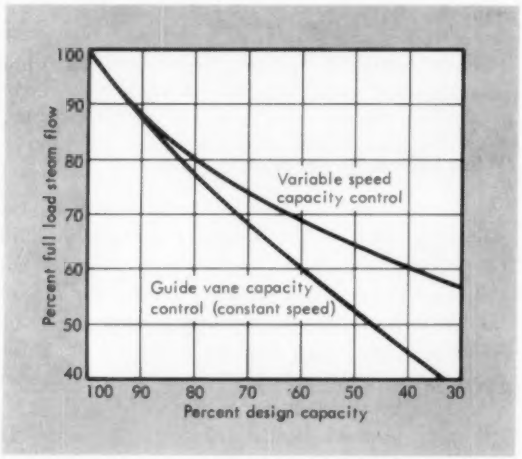
Figure 1 shows typical full-load steam rates as they are affected by steam supply pressures. It is interesting to note that the rates, regardless of pressure, remain equal to or better than full load rates down to about 50 percent of capacity.

Reduced Load Performance Important

While the full load design conditions and performance of a centrifugal water chilling system are apt to be exposed to exhaustive study, too often not enough consideration is give to reduced load performance. It is true that in an industrial process application, the system is called upon to operate at or near full load throughout its life. However, in comfort air conditioning widely ranging demands are made



1 TURBINE STEAM RATE (lb per ton-hr) at part load is given here as percent of full load rate for a centrifugal system with inlet guide vane control and constant turbine speed. Steam rates decrease with increased inlet pressure and are equal to or better than full load rates down to about 50 percent capacity



2 PART LOAD steam flow of turbine driven centrifugal system is affected by capacity control as shown here

upon system capacity. These changes are brought about by seasonal weather variations, building occupancy and lighting fluctuations, and so on.

Accurate studies have been made in various sections of the country, of typical comfort-conditioning installations, to determine the relative periods of time that water chilling systems are called upon to operate at full load, at ¾ load, at ½ load, and at ¼ load. These studies show that in the more moderate climatic sections, the systems may be operating in the ½ to ¾ load range for as high as 75 - 90 percent of its annual operating hours. A typical southern installation was shown to operate for two-thirds of its running time in the ¾ to full load capacity range and about one-third of the time at ¼ to ½ of full capacity.

The above figures indicate the need for intelligent analysis of the anticipated load factor of a proposed installation, and that correct selection of the type of refrigeration system cannot be made by considering only the full load performance of the various alternates.

Part Load Capacity Control

To understand fully the economics of a turbine-driven centrifugal refrigeration system in all its load phases, one must first be aware of the characteristics of the refrigeration cycle at reduced loads and the commonly-employed means for balancing system capacity with changing loads.

The basic purpose of the capacity control applied to centrifugal systems is to maintain a constant chilled water temperature leaving the chiller. Left to its own devices, the compressor would continue to cool the chilled water to correspondingly lower outlet temperature as the load decreased, until it was shut down by a protective device. Therefore, a means is necessary to balance the system capacity to the load requirements. This takes the form of a pneumatic, electric or electronic temeperature controller which senses the temperature of the water leaving the chiller, and transmits a signal capable of changing the system capacity when a tendency to change in this temperature is detected.

This signal may act to open or close guide vanes at the inlet of the first stage of the compressor or to vary the speed of the turbine. The latter is accomplished through the use of a throttling valve in the turbine governor oil system, in the case of an hydraulic governor, or a powered lever mechanism where the governor is of the mechanical type. In either case, the control signal serves to over-ride the normal turbine speed control and establishes a new speed commensurate with the change in load.

The inherent characteristics of a centrifugal compressor are such that a speed reduction of about 25 percent will bring about a capacity reduction of approximately 75 percent. This has a favorable effect upon part load steam consumption, since the steam rate of a turbine increases with decreased speed.

The curves in Fig. 2 show the relative effect on overall steam consumption of a typical centrifugal system whose capacity is controlled by speed variation as against inlet guide vanes. In preparing such an analysis, it is usually assumed that such factors as the flow of chilled and condenser water, the leaving chilled water temperature, and the initial steam supply pressure are held constant. Variable factors are the chilled water range, the entering condenser

water temperature (which is assumed to be 1 F lower for each 10 percent reduction in load) and the exhaust pressure of the turbine (if condensing). This latter is affected by the lower temperature of water coming to the steam condenser from the refrigerant condenser plus the fact that the steam flow is reduced.

Owning and Operating Costs

When comparing the relative cost of owning and operating a steam turbine-driven centrifugal with other refrigeration systems, all important contributing factors must be considered. As mentioned previously, a vital part of the analysis may well rest in the determination of the hours of operation anticipated at other than full load conditions. Once this has been established, it is a simple matter to obtain from reputable manufacturers the power or steam consumption of their equipment at reduced loads, as well as full load conditions. Multiplication of the unit's power or steam requirements at given load points by the number of expected operational hours at these points will result in a relatively accurate forecast of utility demands over a season. With the unit cost of steam or electric power having been established, the seasonal cost of operation of the unit itself may be easily determined.

To this must be added other important considerations, such as the difference in owning and operating costs of auxiliary equipment such as cooling towers, pumps, etc. Credit must be given for economies gained, for example, in supplying other needs with low pressure steam extracted from a high pressure turbine.

Combined Turbine-Absorption Systems

As noted in the previous discussion, a non-condensing turbine may be utilized as a pressure reducing valve when low pressure steam is required. By combining turbine-drive centrifugal systems with absorption systems, the advantages of both may be utilized. In installations of this type, the turbine driven centrifugal machine operates in series with one or more absorption units. Typically, the centrifugal system constitutes one-third of the required capacity. The turbine takes high or medium pressure steam and reduces the pressure to approximately 15 psig. This exhaust steam flows to the absorption unit where it is condensed.

The overall steam rate for the combination system at full load is lower than it would be for either system alone. Steam rates of 13 lb per ton-hr are attainable in such systems. A disadvantage of this arrangement is that at low loads, the turbine must be shut down and steam for the absorption unit taken through a pressure reducing valve.

Gas Turbine Drive Systems

The following information on the application of gas turbines to power air conditioning systems is based on a paper by C. R. Apitz, special representative, gas turbine sales, Clark Bros. Co.

The gas turbine has been the "glamour girl" of the power industry for many years. Early installations have now been in operation long enough to confirm the claims of low operational costs made by the early proponents of gas turbines. Design improvements, equipment unitization, and the development of efficient installation techniques have brought about a continuing reduction in installation costs.

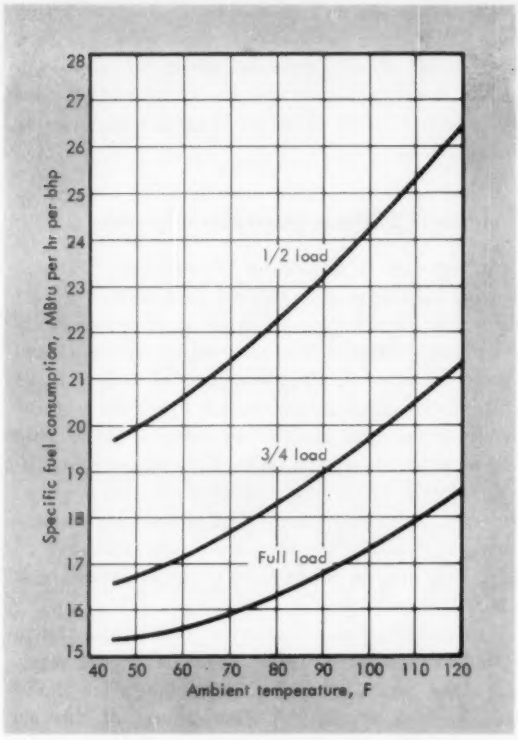
The gas turbine has long had attributes that made it attractive as a prime mover. Two recent developments in the gas turbine industry have made its use even more widespread in general industry. First, the range of sizes has been widened with the introduction of commercial turbines of sizes useful for many industrial applications and having the conservative design required for long life and extended continuous runs at full rated load.

The second recent development can best be described as the concept of "total" application. All power cycles are for the conversion of fuel energy to more usable forms. Some cycles produce shaft power only. The gas turbine actually produces both shaft power and economically recoverable heat energy. When this "total" energy conversion is considered, the gas turbine cycle is one of the most efficient cycles commercially available to industry.

The Gas Turbine Cycle

Before going into the practical application of gas turbines, it might be well to review the basic cycle involved. A 1265 bhp turbine will be used as an example, because all of the data required is available. Similar data also is available for other turbines upon request from the respective manufacturers.

The cycle starts with the introduction of 22.6 lb per sec of air into the 13-stage axial compressor at suction conditions of 80 F and 14.7 psia. The air is compressed through a 4:1 ratio and is discharged into the combustion chamber where it is heated by fuel burning at 1390 F. Fuel is used for the heating of the compressed air at a rate of 16,300 Btu per Bhp per hr (Fig. 3). From the combustion chamber, the hot air passes through four stages of expansion



3 GAS TURBINE specific fuel consumption depends upon load and ambient temperature as shown here for a 1265 hp turbine at sea level

and exhausts to the atmosphere at 890 F.

It is the use of the heat in the 890 F exhaust gas that brings about "total" application. At its nominal sea level rating of 1265 bhp at 80 F the turbine will burn 20.6 MMBtu per hr. Of this heat input, 3.21 MMBtu per hr will be recovered as shaft horsepower output. Depending upon the level of process heat required, the 890 F exhaust gas heat can be exchanged against a process stream to obtain additional energy recovery. As an example, if we are making steam with a 212 F feedwater temperature, we can obtain a commercial waste heat boiler of the forced circulation type that will cool the exhaust gas down to about 350 F and recover 11.3 MMBtu per hr. This results in an energy recovery of 14.51 MMBtu per hr, or a thermal efficiency of 70 percent, which is quite good when compared with other cycles.

In-line Combustion Increases Heat Recovery

If the process heating requirement is greater than that which can be supplied from the exhaust gas by simple heat transfer, then an in-line combustion chamber can be added in the duct between the turbine and the heat exchanger. Since the turbine normally operates on a very lean fuel/air ratio and the hot exhaust gases contain approximately 17 percent oxygen by volume, fuel readily can be burned directly in the exhaust gas stream at 95 percent efficiency.

The overall thermal utilization efficiency will rise as the amount of refiring increases. There is sufficient oxygen in the turbine exhaust gases to accommodate auxiliary refiring up to a rate of about 60 to 65 MMBtu per hr at which point the overall thermal efficiency will be approximately 90 to 92 percent.

Application to Air Conditioning

One of the newest "total" applications, and one that appears to have a great potential, is in the field of air conditioning. The turbine has considerable flexibility in adapting to the requirements of a wide variety of industrial and commercial jobs in this field. In general, the gas turbine driven air conditioning plant is competitive with a steam turbine driven plant but more expensive than motor drive from the standpoint of initial installed cost of the complete air conditioning and heating plant. However, engineering analyses of the cost to own and operate the gas turbine powered air conditioning plant have been compared with the other cycles and on the basis of several independent studies it has been pretty well established that savings resulting from use of the gas turbine will pay-out the incremental investment over any other cycle in less than five years.

The gas turbine will fit a wide range of air conditioning tonnage requirements. The turbine shaft power can be used to drive a 1200-ton packaged mechanical refrigeration unit, a 900 Kw generator for power generation, or other pumps and compressors as required. The exhaust heat from a 1265 hp turbine can be used to produce enough 15 psig steam to drive a 530 ton absorption refrigeration package, or enough 125 psig steam to drive a 675 ton steam turbine driven centrifugal refrigeration unit when either system is producing 42 F chilled water.

One of the most important attributes of the steam produced-turbine waste heat recovery is the sustained efficiency of part load operation, and the fact that it can be used to produce refrigeration in summer, comfort heating in winter or steam for process all year. A combined gas turbine-steam turbine centrifugal air conditioning plant can be designed for a heat consumption of approximately 11,000 Btu per ton-hr.

The comments and data presented in this paper are intended to stimulate further thinking on the subject and should not be considered as an end in themselves. The future of the gas turbine in the field of air conditioning and other fields is a function of the creative thinking of the engineers who design industrial and commercial utility systems. It is hoped that this paper will be helpful in generating that creative thinking. ‡

Chart Correlates Dry Bulb Temperature, Relative Humidity With Wet Bulb Temperature, Yields Temperature-Humidity Index

THE Temperature-Humidity Index (THI) is a measure of the comfort persons experience under certain values of temperature and relative humidity.

However, other factors, which will affect the degree of comfort under any set values of temperature and humidity, must also be taken into account. These include air movement, the amount of activity or exercise by the person, clothing, age, and physiological and psychological condition. Only an average of all these factors can be used as a true indication of a "feeling of comfort" for any given number of persons.

Establish Norm

It has been determined that a substantial percentage of persons feel comfortable when the THI is 70. As the index rises, more people feel uncomfortable.

The Comfort Chart and Effective Temperature pioneered by the American Society of Heating, Refrigerating and Air Conditioning Engineers and published in the Guide also show comfort indices which compare with the new and broadly published THI.

Source of the Indicator

The Temperature-Humidity Index is derived from the formula

$$THI = 0.4\ (DB + WB) + 15$$

where

DB = temperature, F, dry bulb
WB = temperature, F, wet bulb
15 = factor determined by the U. S. Weather Bureau

Nomograph Explains Number

The left-hand nomograph on the following page is based on the above formula. Most people, however, to whom the THI will be quoted as a means of explaining the air conditions which prevail (or which can be expected) are more familiar with relative humidity than with WB temperature. Weather conditions are generally reported by giving the DB temperature (generally referred to simply as "temperature") and relative humidity.

The nomograph to the right on the following page, then, establishes a direct-reading correlation between the DB temperature-relative humidity conditions and the WB tempertaure. A direct reading of the THI can then be made from the center scale.

Example 1

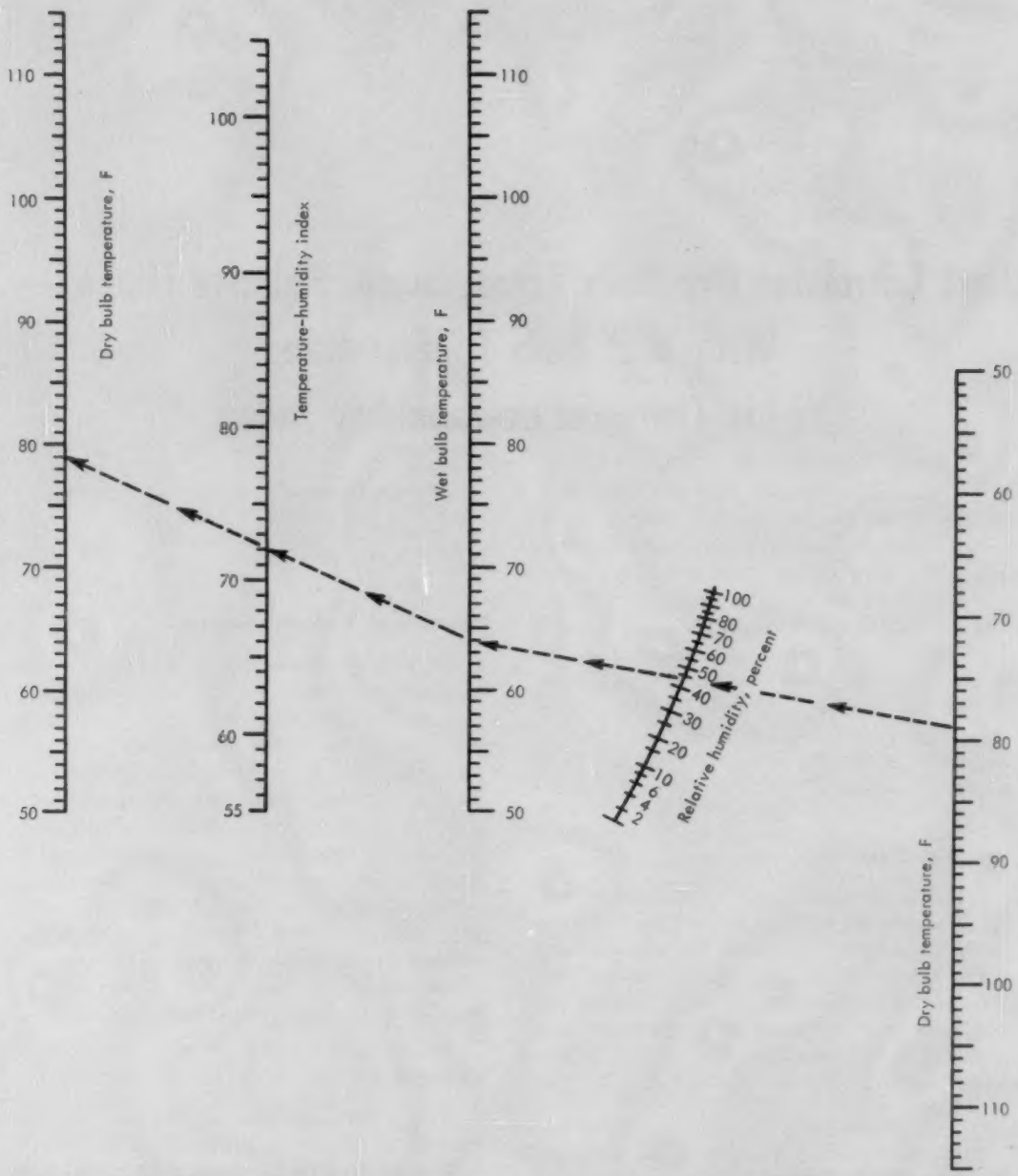
Given a DB temperature of 79 F and a relative humidity of 44 percent, determine the THI.

Solution: Draw a line from 79 F on the right hand scale through 44 percent on the relative humidity scale, and extend it to the WB scale, which it intersects at 64 F WB. From this intersection, draw a line to the 79 F mark on the left hand DB scale.

This line intersects the THI scale at a value of 72.2, which is the equivalent temperature-humidity index. ≠

By H. A. DODGE, P.E.
Consulting Engineer

HPAC DATA SHEET



COMBINATION NOMOGRAPH correlates dry bulb temperature and relative humidity with wet bulb temperature to yield temperature-humidity index (THI)

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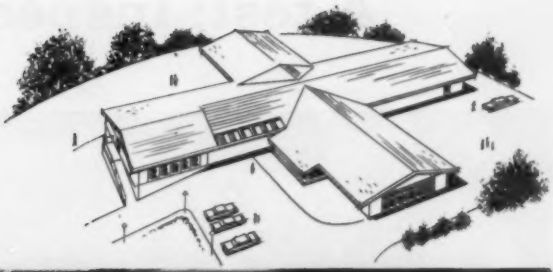

Architect: Albert W. Kahl, San Mateo, California

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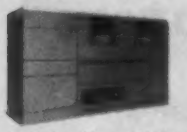
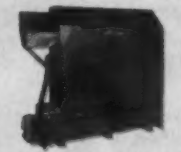
Room Conditioners 200-600 cfm

Cooling Towers 3-120 tons



Pkgd. Air Conditioners 3-60 tons



Evap. Condensers 10-110 tons

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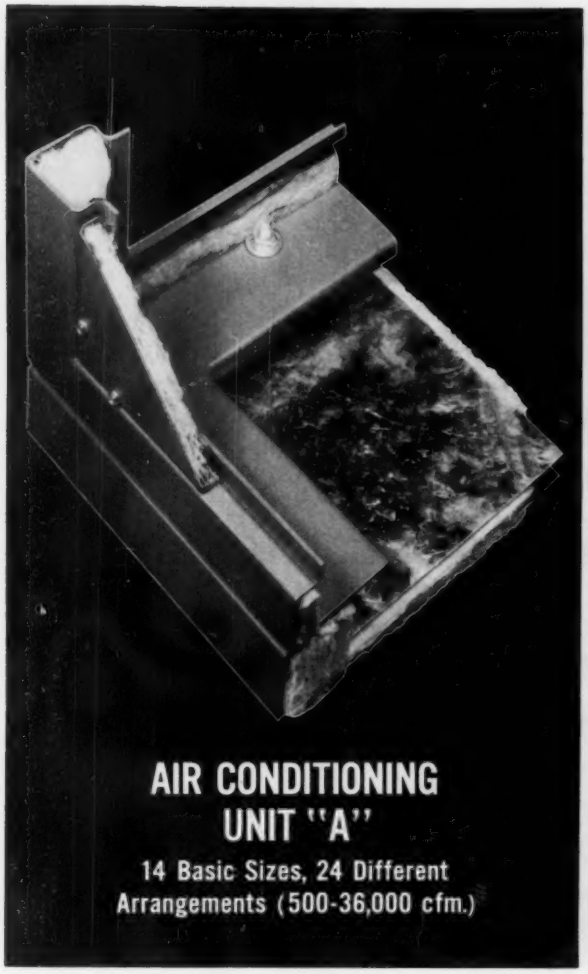

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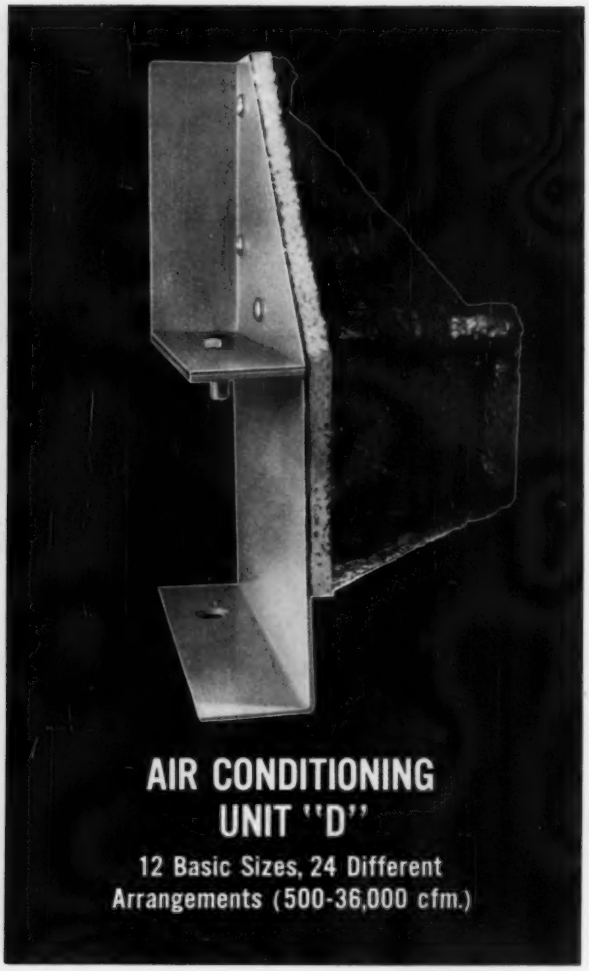
14 Basic Sizes, 24 Different
Arrangements (500-36,000 cfm.)



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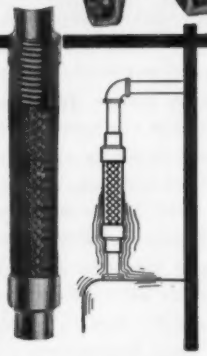

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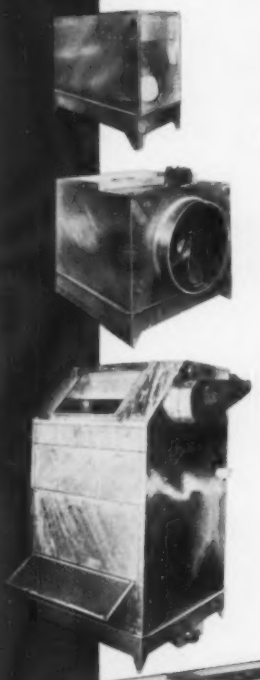

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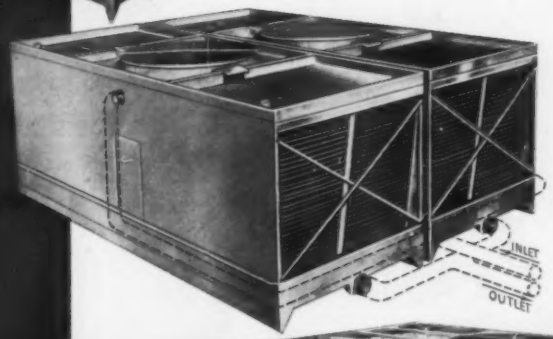

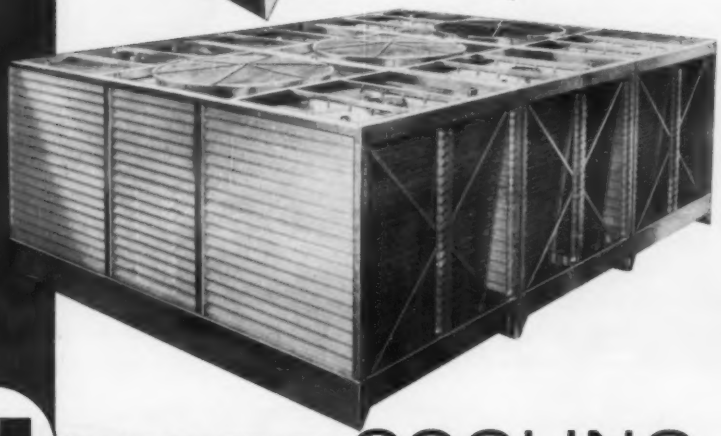

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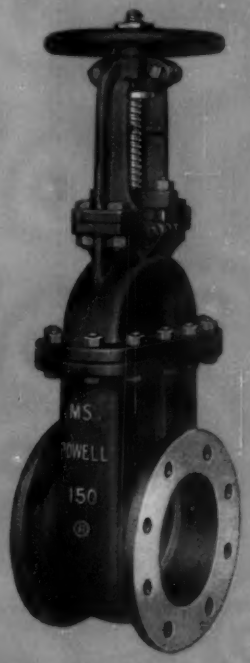
150-pound Bronze Gate Valve—Fig. 2714. Union bonnet. Inside screw rising stem. Sizes, ¼" through 3" with solid wedge; ½" through 3" with split wedge.

150-pound Bronze Globe Valves—Fig. 150. Union bonnet. Renewable composition disc. Sizes, ⅛" through 3". Angle and flanged end valves can be supplied.



150-pound Bronze Gate Valve—Fig. 1414G. Bolted, flanged yoke-bonnet. Outside screw rising stem. Solid wedge. Sizes, 2" through 12". Screwed end valves can be furnished.

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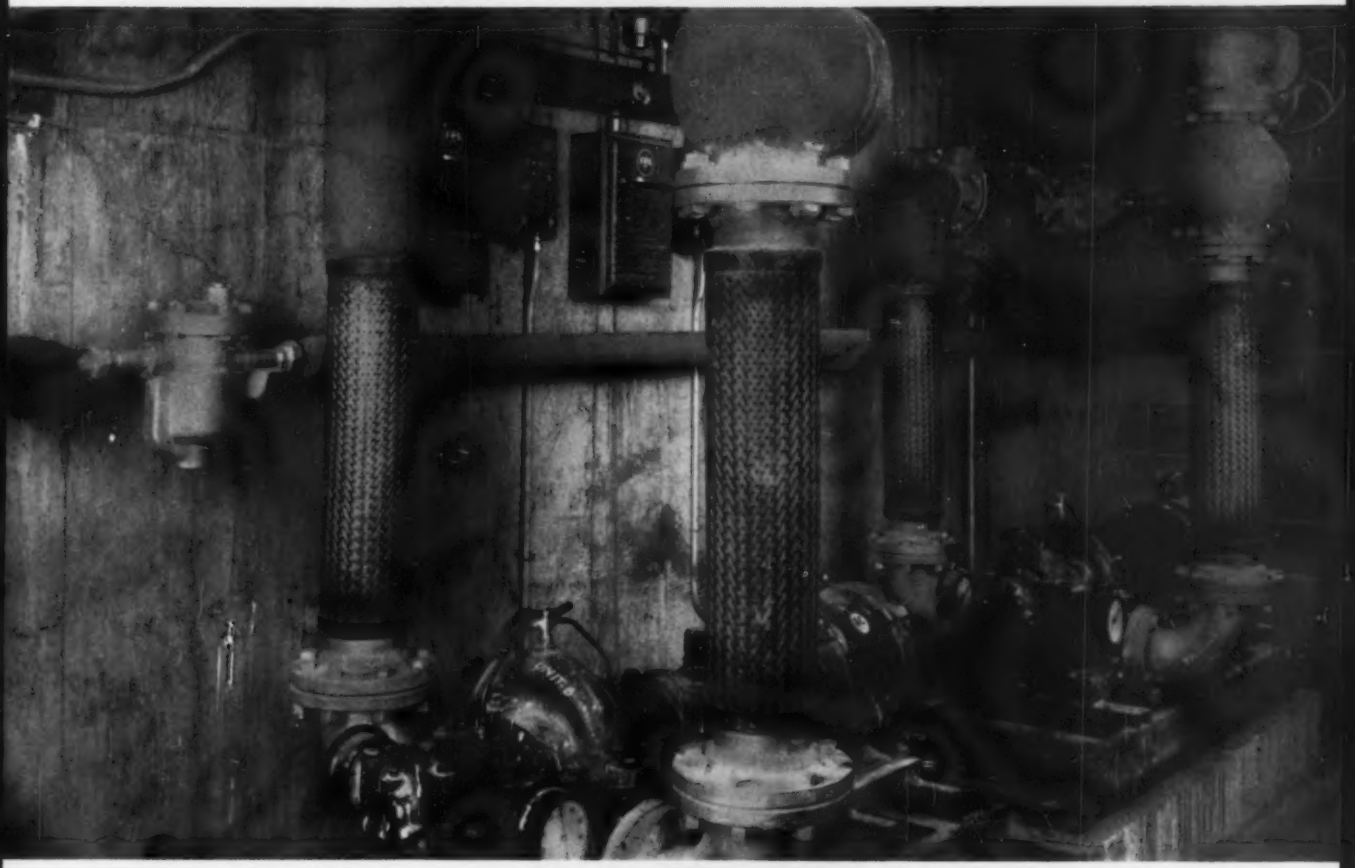

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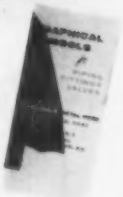
Flexpipe connectors are the mark of modern heating systems

More and more contractors are streamlining piping installations with Flexpipe. These connectors permit greater compactness, cut installation time, are easier to install in tight quarters and can handle offset. Flexpipes take up movement caused by expansion and contraction over wide variations in temperature. Conventional piping usually requires far more work area . . . and costly, time-consuming installation of elbows, couplings, short runs of pipe.

Flexpipe flexible core can be either bronze, galvanized steel or stainless steel—I.D.'s range from ¼" through 16".

WHERE TO BUY: Leading wholesaler distributors can provide information about Flexpipe in standard sizes. For name and address of the distributor serving your area, or for more detailed information, write to: Anaconda Metal Hose, P.O. Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-647

Above: the sleek, efficiently designed Hamilton-Whitten Halls, Women's Residence Halls, Illinois State Normal University, Normal, Illinois.



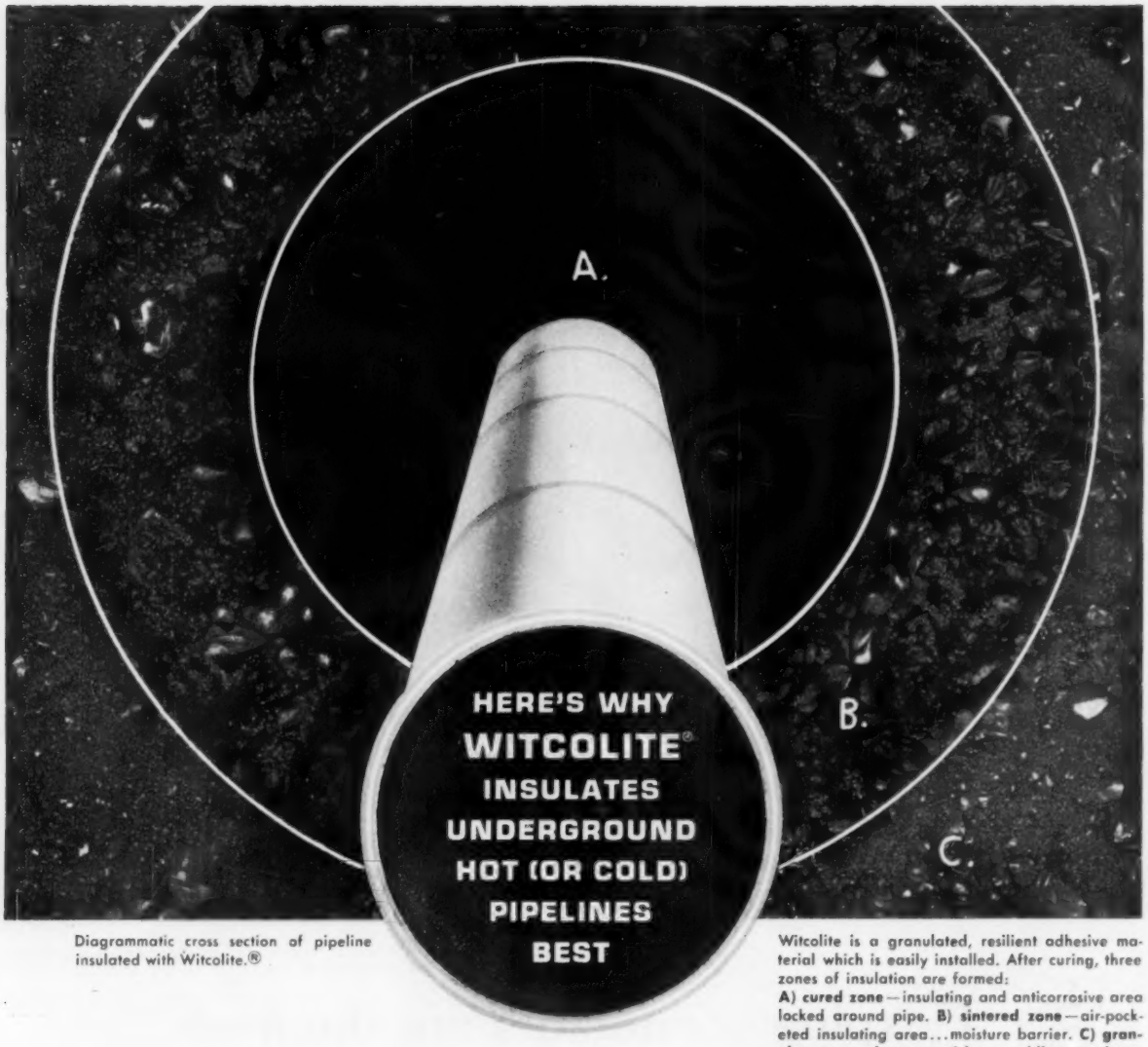
Flexpipe®

an

ANACONDA®

product

Write to Dept. HD for handy Graphic Symbols booklet. Quick, easy key to all symbols used for pipe fittings, valves and piping.



Diagrammatic cross section of pipeline insulated with Witcolite.®

Witcolite is a granulated, resilient adhesive material which is easily installed. After curing, three zones of insulation are formed:
A) **cured zone**—insulating and anticorrosive area locked around pipe. B) **sintered zone**—air-pocketed insulating area...moisture barrier. C) **granular zone**—loose particles providing maximum thermal insulation.

WITCOLITE OFFERS ALL THESE ADVANTAGES

3 LABORATORY-CONTROLLED GRADES of granulated particle size assure perfect high thermal insulation of underground hot pipes...even with pipes alternately conveying hot and cold liquids. **HIGH THERMAL INSULATION** is the result of Witcolite's three zone protection. The product resists physical breakdown and adheres resiliently to pipes as they expand and contract with temperature changes. **HIGH CORROSION RESISTANCE** protects pipes permanently against acids and alkalis found underground. Witcolite is also effective against electrolytic processes. **HIGH WATER RESISTANCE,** results from the surface tension differential between water and Witcolite. No wetting of the underlying surface occurs. **LOWEST COST** of any quality material on an installed basis is an extra plus with Witcolite.
For further information or technical literature on Witcolite, simply write or call the nearest Witco office listed below for your local representative's address.

Witcolite is delivered to your job site in convenient, easily handled 50 pound multi-wall paper bags.

WITCO CHEMICAL COMPANY, Inc.
PIONEER PRODUCTS DIVISION
Dept. 81-03, 122 East 42nd Street, New York 17, N.Y.

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Sales offices: New York • Chicago • Los Angeles • Toronto and Montreal, Canada

EQUIPMENT DEVELOPMENTS

Centrifugal Compressors Available from 6 to 600 tons

Heavy duty single stage centrifugal compressors available from 6 to 600 tons, depending on the refrigerant used and the temperature levels. For use with Refrigerants 11, 114, 12, and 22. Can be direct driven by electric motor, steam turbine, gas turbine, or gas engine. Operates in a range of 800 to 7000 cfm. Automatic pre-rotation vanes give wide range capacity control. — *York Div., Borg-Warner Corp., York, Pa.*

Power Gas Conversion Burner Available in Packaged Unit

Gas-fired units have a maximum input of 800,000 Btu per hr. Motor and blower housing of heavy duty pressed steel construction. Blower equipped with 3450 rpm motor. Controls are standard electronic type. Stability of flame is accomplished by a whirling gas drawn into a spray of metered secondary air. A small portion of the gas-air mixture is directed to a retainer where a slow burning ring of gases serves to stabilize further and retain the cyclonic flame within burner head. Literature sent on request. — *Roberts-Gordon Appliance Corp., 44 Central Ave., Buffalo 6, N.Y.*

Return Air Grilles Have Large Free Areas

High capacity return air grilles available in sizes ranging from 10 × 4 in., with 25 sq. in. of free area, to 36 × 36 in., with 920 sq in. of free area. One-piece units in sidewall, baseboard, or out-of-wall styles. Face bars stamped ½ in. wide on a ½ in. center with bars set at 30 deg angles. Deflection can be either up or down. — *Auer Register Co., 6600 Clement Ave., Cleveland 5, Ohio.*

Cooling Tower Has Horizontal Double-Fan Discharge

Unit has nominal rating of 120 tons, based on a capacity of 360 gpm of water at 95 F entering water temperature, 85 F leaving water temperature, and 78 F wet bulb temperature. Double fans draw air from the open back of the tower through the wetted deck surface. Cabinets are weatherized, made of electrically-welded 14-gage steel; 10-gage steel cabinets available on special order. Information sent on request. — *Halstead & Mitchell Co., Bessemer Building, Pittsburgh 22, Pa.*

Evaporative Air Coolers Have Capacities Up To 5500 Cfm

Unit with horizontal discharge available in sizes of 2000, 3000, 4000, 4500, and 5500 cfm. Flange built into unit for easier installation to ductwork. Features rubber-cushioned blower shaft bearings; all-plastic recirculating pump; and a metered water-distribution system. — *Dearborn Stove Co., 1700 W. Commerce, Dallas 22, Tex.*

INFORMATION on capacities, dimensions, applications, and special features in each **EQUIPMENT DEVELOPMENT** item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details.

Other Departments . . .

- **Recent Trade Literature 217**
- **We Hear That 222**
- **Meetings and Conventions 225**
- **New Books and Reports 227**

INSTANT HOT WATER FOR ALL NEEDS

Instantrol Regulator Assembly

Hot/Cold Water Mixer

Approved in schools, hospitals and industrial plants, this Robertshaw team keeps its users in hot water—and the contractor out of it!

The heat-anticipating Instantrol bulb provides instant hot water under perfect control, *regardless of widely fluctuating load changes.* Adjustable within 90°-200° F. limits, the Instantrol Regulator Assembly includes patented anticipating bulb, "dead end" valve, necessary tubing, etc. It is also available as a complete Heater Package, ready for installation.

In typical applications, the Instantrol Assembly supplies constant hot water for dishwashers, sterilizers and high-temperature processes—and the Hot/Cold Water Mixer tempers this same supply to the lower temperature requirements of shower rooms, wash basins, etc.

Write for full specifications on these and other dependable Robertshaw Controls for the building maintenance field.

Ask for Catalog LH-1700.

Robertshaw

MR. CONTROLS

Robertshaw-Fulton Controls Company

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EQUIPMENT DEVELOPMENTS

Continued

Fan-Coil Units Available in Ceiling, Wall Mounted Units

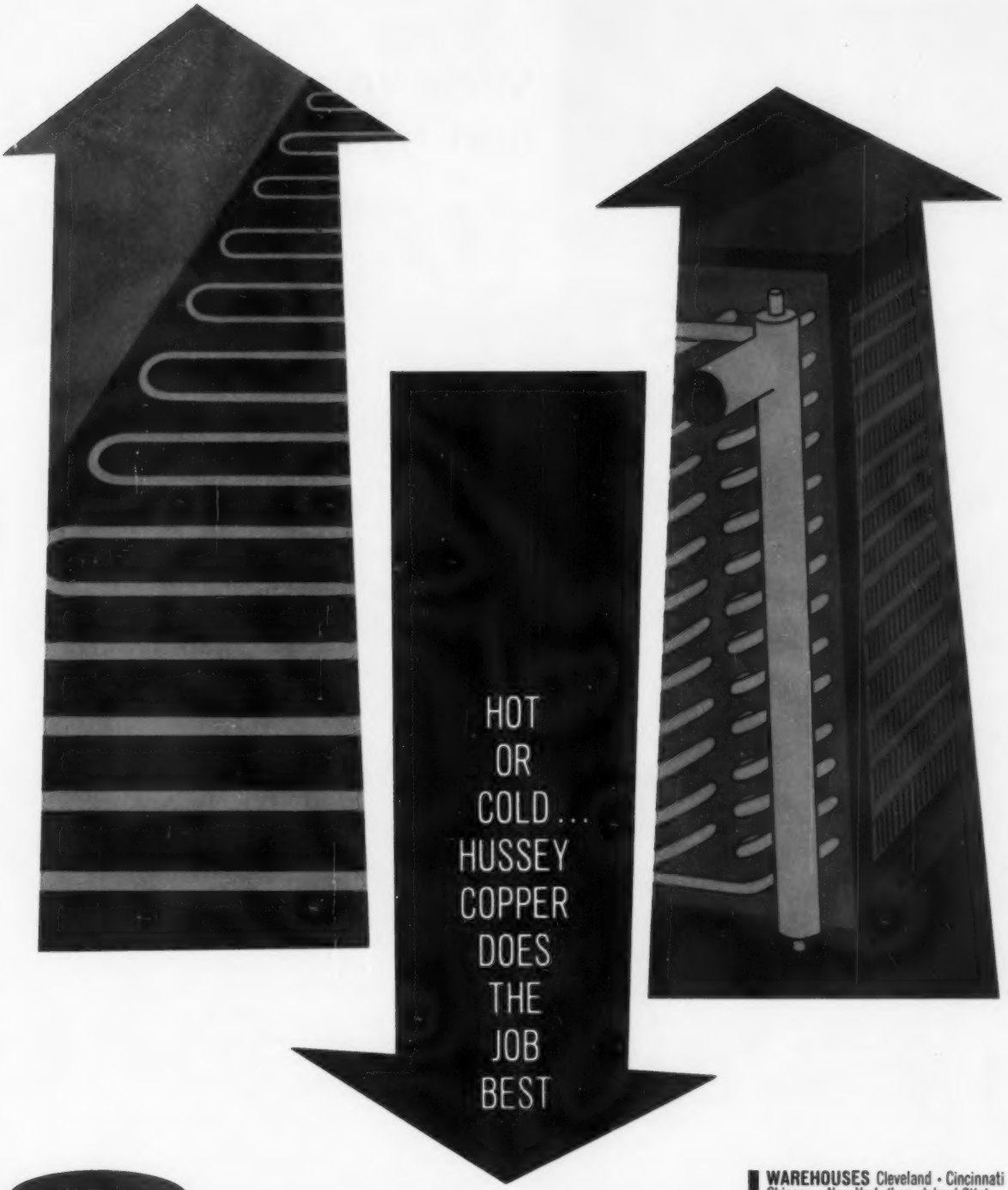
Units for peripheral cooling and heating and applications over closets or furred-down areas. Capacities range from 200 to 600 cfm with future models to range to 1200 cfm. Overall depth is 8½ in. Has three speed motor with switch, mounted on rubber. Double inlet blowers directly connected to motor. — *Drayer-Hanson Div., Hi-Press Air Conditioning of America, Inc., P. O. Box 2215, Terminal Annex, Los Angeles 54, Calif.*

Water Treatment for Small Cooling Towers, Condensers

Water treatment protects against corrosion, scale formation, and slime formation in small cooling towers and evaporative condensers. Treatment supplied in a self-feeding disposable unit. Bulletin 410 sent on request. — *Universal Refining Products Co., Inc., 1133 Broadway, New York 10, N.Y.*

Centrifugal Pumps Available in Package Models

Packaged, close-coupled, end-suction centrifugal pumps for use with air conditioning units, cooling towers, hot water circulators, and other applications. Complete disassembly possible without disturbing suction or discharge piping. Vertical centerline discharge makes pumps self-venting. Available in a range of sizes from ¾ × 1 in. to 3 × 3 in. Capacities range up to 400 gpm with heads up to 150 ft. Information sent on request. — *The Aurora Pump Div., The New York Air Brake Co., 619 Loucks St., Aurora, Ill.*



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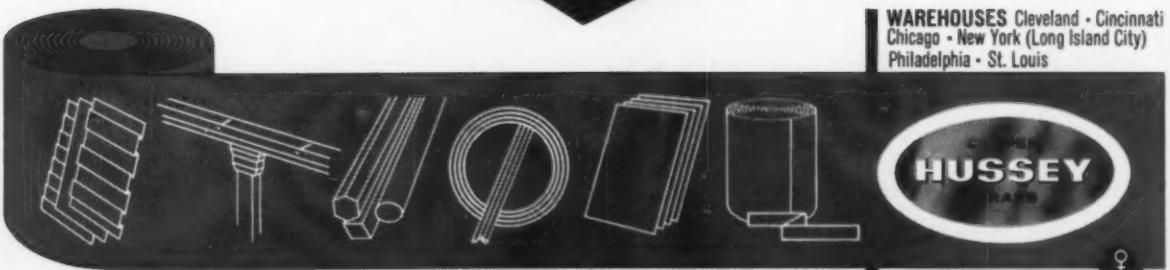

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DIVISION OF
COPPER RANGE COMPANY

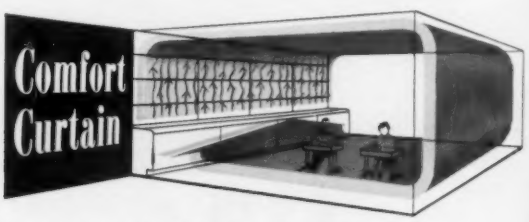
MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

Why ventilate just half a classroom?

The ribbons tell the story! Uniform air distribution . . . the full length of the classroom . . . guarantees room-wide comfort

These children are demonstrating how Lennox COMFORT CURTAIN® provides an ideal climate throughout the entire classroom, rather than just a portion of it. The ribbons indicate how a "curtain" of conditioned air discharges quietly and evenly along the entire length of the exterior wall. Then it moves rapidly up to the ceiling and across to the far wall—well above the occupants—then softly down and through the occupied area in returning to the outer wall. This full perimeter distribution blends and circulates all the air in the room so that its movement measures only 25 to 40 ft. per min. in the occupied area—so gentle as to be unnoticed except for improved comfort. Lennox COMFORT CURTAIN blends and filters fresh outdoor air with heated air and recirculated air. Holds room temperature within ½° of thermostat setting. For complete information about a COMFORT CURTAIN system and its use with all types of heat sources, write LENNOX, 541 S. 12th Ave., Marshalltown, Iowa, or contact your nearest Lennox office.

LENNOX®



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...Only

LENNOX

Comfort Curtain® provides full room air circulation

Yet it cost less than $1.10 per sq. ft. to provide individually controlled fresh air ventilating and heating in each classroom of this school

High School—Reorganized School District R-3
Pleasant Hill, Missouri
Matthews and Hillman, Architect & Engineer

No central heating plant, with expensive duct or piping system, was needed in this building. Gas-fired units, in approved heater rooms located between each two classrooms, supply warm air to the COMFORT CURTAIN systems. Simple openings in the exterior walls admit fresh outside air to the equipment in each room. Prefinished wall duct sections, along the entire length of the outside wall in each room, provide the full perimeter air distribution that assures full-room air circulation. Simple structural requirements and ease of installation reduced both initial costs and over-all expenditures. "Day-Nite" thermostats in each room have "no-occupancy" settings to save fuel and make after-hours use of individual rooms economical. Modular design enables new units to be added economically with future building expansion.

EQUIPMENT DEVELOPMENTS

Continued

Indicators and Indicating Controllers Feature 56 Sq In. Panels, Over 50 Range Scales

Self-balancing indicators can be used with hundreds of sensing elements connected through any type of multi-point switches or connector panels. Indicating controllers provide two or three position control of industrial processes. Built with either bridge or potentiometer circuits. Service from front since whole chassis slides forward on built-in tracts. Accuracy is 0.25 percent of full scale; sensitivity is 0.125 percent, unaffected by normal variations in line voltages, amplifier tubes, or component parts. — *Thermo Electric Co., Inc., Saddle Brook, N.J.*

Clay Pipe Available in 5 Ft Lengths, 4 to 12 In. Diameters

Vitrified clay pipe available in 5 ft lengths with diameters of 4, 6, 10, and 12 in. Larger sizes also available. Has "Wedge-Lock," slip-joint, or conventionally jointed bell and spigot clay pipe, standard and extra strength. — *Logan Clay Products Co., P. O. Box 698, Logan, Ohio.*

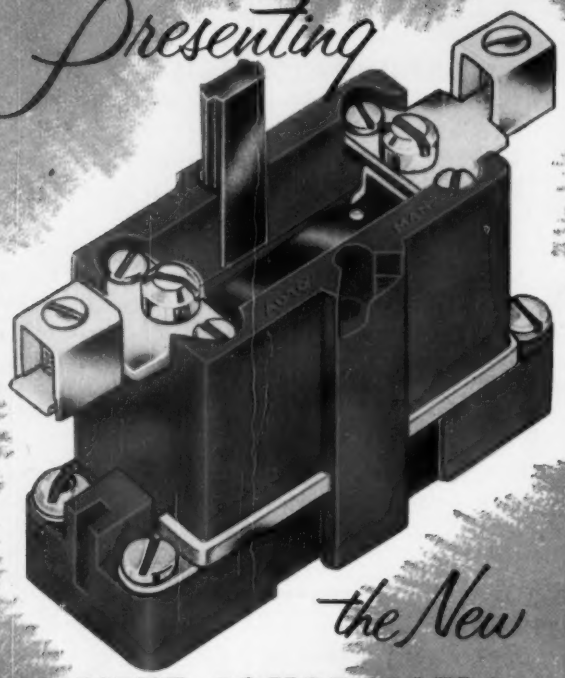
High-Velocity Sound Absorber Employs Free-Air Body Principle

Unit incorporates a free-air component in control of sound for high velocity temperature systems. Made of heavy gage galvanized sheet steel, unit utilizes an absorber within an absorber design to provide a greater area of exposed glass fiber without appreciably affecting the in-system air velocity. Missile-like nose cones, front and rear on the free-air body, provide a 360 deg distribution of air entering the absorber. Can be used in both old and new construction. Available in standard circumferences or made to order. — *American Engineering Co., High Point Industrial Park, Sedalia, Mo.*

Heat Resistant Tape For Sealing Ductwork

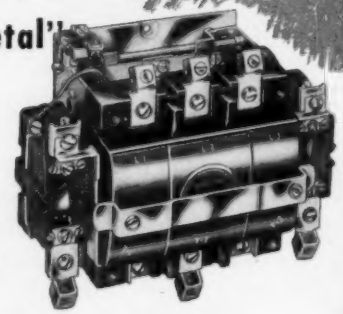
Tape has a cloth backing and a reclaimed rubber-based pressure sensitive adhesive. Has a thickness of 0.014 in. and its adhesion to steel is 45 oz per in. width. Tensile strength is 45 lb per in. width. — *Arno Adhesive Tapes, Inc., Michigan City, Ind.*

Presenting



the New

AMBIENT COMPENSATED OVERLOAD RELAY with "Balancing Bi-Metal" Exclusive with ARROW-HART



RELIABLE OVERLOAD PROTECTION FROM −20°F TO +165°F!

FOR ALL ARROW-HART "RA" MAGNETIC STARTERS, NEMA SIZES 0 THROUGH 5!

Now, for the first time, you can give your customers reliable overload protection regardless of heat or cold . . . because this compact new A-H Overload Relay operates on the same time curve at all temperatures from −20°F to +165°F. Simple, rugged, dependable mechanism features the exclusive A-H "Balancing Bi-Metal." Much smaller than any other comparable units, these relays have the same base size as standard A-H Overload Relays, use the same regular or quick-trip heaters, and can be used on any A-H Type "RA" Magnetic Starters. Compensation is completely automatic . . . no field adjustment is needed. Available with ratings from 25 to 300 amperes, continuous current. Ideal for use outdoors, in installations subject to wide seasonal changes in ambient temperature . . . or indoors, in installations subject to wide daily changes!

Write today for complete information. The Arrow-Hart & Hegeman Electric Co., Dept HPAC 103 Hawthorn St., Hartford 6, Conn.

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Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

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EQUIPMENT DEVELOPMENTS

Continued

Centrifugal Dust Collectors Range Up To 2500 Cfm

Units primarily for removing dust, chips, and shavings, etc., but will also handle materials having the consistency of flour. Blower features a self cleaning, radial design wheel to handle light materials without clogging. Fan is located on "clean" air side of unit to prevent damage from large pieces of material. Ranges from 1250 to 2500 cfm. Motor and blower are end-mounted and detachable for relocation of the outside duct. Information sent on request. — *Torit Manufacturing Co.*, 1133 *Rankin St., St. Paul* 16, *Minn.*

Relief Valves for All Pressure Systems

Units of all type of pressure systems available with 15 to 200 psi settings. Includes "Neoprene" seals, stainless steel springs, and cast red brass bodies. Some are equipped with calibrated adjusting keys. Special units available for high temperature use. Information sent on request. — *Mansfield Sanitary, Inc., Perrysville, Ohio.*

Sectional Pipe Insulation For Temperatures to 1200 F

Multi-layer sectional pipe insulation withstands temperatures up to 1200 F. Composed of bonded felts of calcium silicate and asbestos fiber. Sections can be cut and fabricated in field; sawing creates virtually no dust, and the insulation's materials are non-irritating to workmen's skin. Multi-layers are crush-resistant. Information sent on request. — *Keasbey & Mattison Co., Butler Ave., Ambler, Pa.*

EQUIPMENT DEVELOPMENTS

Continued

Year Around Air Conditioner Has Four-Section Heating and Cooling Element

Unit for schools, hotels, hospitals, and similar applications has a heating and cooling element that is circuited to operate as four separate elements, each controlled by a valve. Extracts moisture from the air in direct ratio to the requirement for dehumidification. A pivoted vane suspended in the outside air opening of the unit maintains desired volume of air regardless of wind velocity. Can be mounted on ceiling or floor. Bulletin 602-1 sent on request. — *John J. Nesbitt, Inc., State Rd. & Rhawn St., Philadelphia 36, Pa.*

Plastic Slotted Outlet For Ceiling Air Distribution

Extruded plastic tube slotted for ceiling air distribution used with any kind of acoustical tile ceiling which forms a plenum. Can be adjusted from within the room. Technical literature sent on request. — *Elof Hansson, Inc., Acoustical Div., 711 Third Ave., New York 17, N.Y.*

Variable Volume Reheat Unit For Perimeter Area Service

Unit for heating, cooling, and ventilating perimeter areas of commercial and industrial buildings. Can be used with high or low pressure systems. Makes possible the design of fan capacity by the cooling air flow required at a specific time. Catalog sent on request. — *Titus Manufacturing Corp., Waterloo, Ia.*

Expansion Tanks Available For Industrial Applications

Pressurized diaghragm-type expansion tanks for commercial and industrial installations of hydronic heating. Includes a pressurized tank, and a diaphragm to separate air cushion from system water. Bulletin 118-E sent on request. — *American Tube & Controls, Inc., 100 Pulaski St., West Warwick, R. I.*

Rugged Design...
Easy-to-Handle Balance

RIDGID®

HEAVY-DUTY
PIPE
CUTTERS

give faster, straighter cuts

Five Sizes for ⅛" to 6"

Pick up a RIDGID Heavy-Duty Pipe Cutter, and you'll instantly know why it makes pipe and conduit cutting far easier. Perfectly balanced . . . gives you a feel of confidence no other cutter can match. See the extra-long shank that protects handle threads . . . assures easy pressure application. Feel the large, smooth handle that gives you a comfortable, powerful grip. Try it, and you'll find a built-in cushion to keep the cutter wheel "on track" through hard or uneven spots. Rugged frame, guaranteed not to break or warp, stays straight for clean cuts every time.

You'll Want a RIDGID 4-Wheel Pipe Cutter for Work in Tight Places!

Call your Distributor today. For your convenience, he maintains a complete stock of RIDGID Work-Saver Pipe Tools and parts!

RIDGID

The Ridge Tool Company • Elyria, Ohio, U.S.A.

Wrap up tough duct insulating jobs fast with ULTRALITE®

Unusually shaped duct systems, such as the one recently installed in the showroom of the Jerry Green Car Agency, Kansas City, Mo., are faster, easier, and more economical to insulate with ULTRALITE. Made exclusively of long, strong textile-type glass fibers, ULTRALITE is extremely lightweight and flexible, making it easy to wrap around oddly-shaped duct systems. What's more, its high resilience keeps ULTRALITE from compressing and losing its maximum thermal efficiency at the corners of the duct. Ease of handling makes ULTRALITE particularly desirable where working conditions are cramped or otherwise confining.

For high thermal efficiency, low installed costs and permanence, your best insulation buy is ULTRALITE. Write today for complete information.

FOR INFORMATION AND DELIVERY
CALL YOUR LOCAL ULTRALITE DISTRIBUTOR
(LISTED IN THE YELLOW PAGES)

GUSTIN-BACON *Manufacturing Co.* GUSTIN gb BACON®

220 W. 10th St. Kansas City, Mo.

Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

EQUIPMENT DEVELOPMENTS
Continued

Aluminum Jackets Protect Insulated Pipe Ells

Aluminum ell jacketing for solving problem of "ell joint cracking" on insulated piping. A hump is located at the vertex of the bend to permit unit to fit 109 combinations of pipe sizes and insulation thicknesses from a selection of 13 manufactured sizes. Will fit any ell from 3 through 12.81 in. OD, either long or short radius ells. For screwed or socket welded fittings; attached by metal bands, screws, or rivets. — *General Aluminum Supply Co.*, 1515 *Eastern Ave., Kansas City* 26, *Mo.*

Skylight Vents Heat, Smoke, Or Shock Waves Through Roof

Combines a heat, smoke, and explosion relief unit with a skylight feature. Has large glass fiber windows. A quick release chain allows manual operation from below; handles on unit permit opening from roof without disturbing release mechanism. When dampers are open, snubber chains and springs hold them vertical for maximum draft. — *Swartwout Fabricators, Inc.*, 100 *E. North St., Kokomo, Ind.*

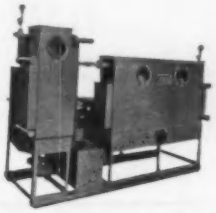
Electronic Air Cleaner in 300, 600, and 1200 Cfm Units

Unit removes smoke and oil mist from machining and grinding operations. May be mounted on the grinding machine or remotely located. Power pack incorporates selenium pencils and d-c capacitors. A circuit regulator provides built-in protection against overload of components and automatic compensation for 120 a-c voltage variations. — *Trion, Inc., McKees Rocks, Pa.*

frost-free cooling as cold as -90 F

Consulting firms are more and more taking advantage of Kathabar engineers' specialized knowledge about frost-free cooling at sub-freezing dry bulbs and dew points. This knowledge has been accumulated in many successful applications—such as candy cooling, photo film chilling, beer fermentation, ammonium nitrate processing, environmental testing, bakery dipping and icing, and radiant panel cooling.

In all cases, Kathabar equipment eliminates freeze-ups, fluctuating efficiency, defrosting shutdowns, duplicate sets of coils.
Take advantage of Kathabar's fund of specialized knowledge . . .



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where the experts turn for help

SURFACE COMBUSTION, 2384 Dorr St., Toledo 1, Ohio
a division of Midland-Ross Corporation MR

Send facts on frost-free cooling for the following application: .....
.....
name & title .....
address .....
street .....
city .....*zone* .....*state* .....

FOR STEAM PROCESS EFFICIENCY
WE RECOMMEND

Super-Silvertop
INVERTED BUCKET TRAPS for:

Autoclaves
Bare Pipe
Calenders
Coffee Urns
Convectors
Corrugated Paper Making Machines
Drain Pans
Dress Forms
Drips
Dry Cans
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Flat Work Ironers
Header Drips
Hot Water Heaters
Kettles
Pipe Coils
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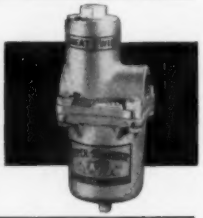
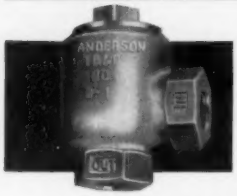
Sterilizers
Submerged Surfaces
Tumblers
Unit Heaters
Vacuum Canners
Warmers

Heat-Kwik
COMBINATION TRAPS for:



Autoclaves
Cooking Kettles
Dryers
Expellers
Kettles
Rendering Cookers
Retorts
Slashers
Submerged Surfaces
Tempering Apparatus
Unit Heaters
Water Heaters

or wherever fast heating up is desired

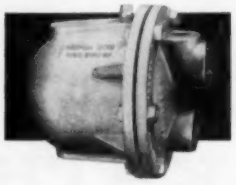


Quik-Flex
THERMOSTATIC STEAM TRAPS for:

Autoclaves
Cooking Kettles
Dryers
Expellers
Kettles
Retorts
Slashers
Sterilizers

or wherever fast heating up, or outside freeze-proof installations are required.

Anderson
FLOAT TRAPS for:



Air Purifiers
Gas Purifiers
Condensate Flow Meters
False Water Line Sewers
Master Trapping Separators
Air Separators
Gas Separators
Air Receivers
Gas Receivers
Gas Scrubbers

or wherever continuous discharge is necessary

Anderson has no "axe" to grind. With a complete line of traps we provide an honest recommendation for all your trap problems. Write for your free book "How to Select Steam Traps" . . . written to give you an unbiased opinion in answer to all your steam trap difficulties.

SUPER SILVERTOPS STEAM TRAPS
BY THE MANUFACTURERS OF Hi-eF PURIFIERS

THE V. D. ANDERSON COMPANY
Division of International Basic Economy Corporation
1949 West 96th Street • Cleveland 2, Ohio

EQUIPMENT DEVELOPMENTS
Continued

Air Conditioner for Unitary Or Remote Installation

Unitary central air conditioner is readily convertible for remote installation. Split chassis design has compressor-condenser section separated from the evaporator section by a bulkhead, permitting installation in one piece or when equipped with four cut-off service valves, for remote installation. Five hp unit available in four models with capacities up to 60,000 Btu per hr. Two models have heat pumps and optional supplementary resistive heating. — *Fedders Corp., 58-01 Grand Ave., Maspeth 78, N.Y.*

Multi-Chemical Dispenser For Cooling Water Treatment

Flow-responsive machine delivers chemical treatment for the maintenance of commercial and industrial air conditioning units. Blends any prescribed water-soluble material with water or other liquids at the rate of 1 oz per gal. This ratio does not vary with water pressure. Treats up to 360 gph of water. Unit measures 7½ × 3¾ in. and weighs 3½ lb. Literature sent on request. — *Proportioning Devices Div., Royal Industries, Ltd., NW Corner, 8th & Wood Sts., Vineland, N.J.*

Spiral-Wound Gasket Seals At Temperatures Up To 1900 F

Gasket seals at temperatures from 1250 to 1900 F. Uses a ceramic paper filler which is non-flammable, completely inorganic, and a chemical insulator. Spring loaded unit is 0.06 in. thick. Information sent on request. — *Garlock Inc., 402 Main St., Palmyra, N.Y.*

No compression problem with new Rigid Armaflex

Here's a simple solution to the problem of insulation compression. It's familiar foamed plastic Armaflex in new form. It's rigid. It holds its shape at pipe hangers, underground, or in any other location where compression is likely to be a problem. Along with its load-bearing ability, Rigid Armaflex, like flexible Armaflex 22, stops condensation on cold lines operating down to zero and below and cuts heat loss on piping to 220 F.

Rigid Armaflex is the latest addition to a complete line of Armstrong Armaflex products, including flexible Armaflex 22 tubing, Armaflex Sheet Insulation for tanks, large pipes and fittings, and Armaflex Finish and Adhesives that assure a neat and reliable job. For full product information and complete application specifications on Rigid Armaflex and other Armaflex insulations, write today to Armstrong Cork Company, 2206 Sherman Street, Lancaster Pennsylvania.

Armstrong INSULATIONS

CUT MAINTENANCE COSTS

with this new design duct fan

Entire half of cone comes off . . . not just an access door . . . exclusive feature

While the DE BOTHEZAT® Bifurcator® **remains in the duct,** this new design duct fan provides an **easier, quicker** way to remove the fan wheel or motor . . . **speeds up** periodic inspections of fan wheel and extension shaft. The entire half of the cone unbolts and comes off, allowing plenty of room to work.

U.S. Patents 2,898,030, 2,978,167

dependable . . . easy to install

Installation is as fast and simple as putting in a section of ductwork. DE BOTHEZAT direct drive motor, completely isolated from fumes and heat, insures steady, trouble-free operation over long periods. Ideal for handling corrosive fumes.

Write for literature. Use coupon below.

MAIL COUPON TODAY!

DE BOTHEZAT FANS DIVISION, Dept. HPA-661
American Machine and Metals, Inc.
East Moline, Illinois

Yes, I'm interested in cutting maintenance costs with DE BOTHEZAT Bifurcator Fans and the exclusive removable cone design. Please rush descriptive literature.

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Published ratings on DeBothezat Fans tell you exactly what the complete fan unit puts out. No guesswork — no allowance to be on safe side!

De Bothezat®

DE BOTHEZAT FANS DIVISION OF
American Machine and Metals, Inc.
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TROY LAUNDRY MACHINERY • RIEHLE TESTING MACHINES • DE BOTHEZAT FANS • TOLHURST CENTRIFUGALS • FILTRATION ENGINEERS • FILTRATION FABRICS • NIAGARA FILTERS • UNITED STATES GAUGE • AUTOBAR • AUTOMATIC DEVICES • LAMB ELECTRIC COMPANY • HUNTER SPRING COMPANY • GLASER-STEERS CORPORATION

EQUIPMENT DEVELOPMENTS
Continued

Pump Design Allows Service Without Disturbing Piping

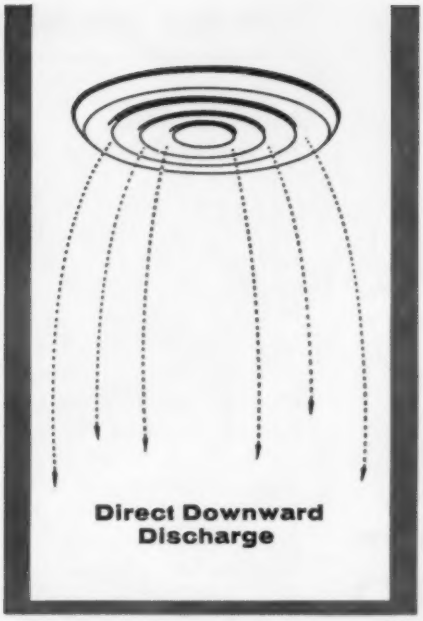
Unit combines features of a horizontal split case type with a vertical turbine and close coupled design. Complete service is possible without disturbing piping or drive motor. May be mounted directly within a pipe run without separate foundation. Furnished with both inline suction and discharge connections, or the bottom suction and side outlet configuration. Uses all standard motor speeds up to 3600 rpm. Can be applied to steam turbines when required. Standard capacities up to 1500 gpm at discharge heads of over 300 ft. Temperature limit is 450 F. — *Sempco Corp., P.O. Box* 2291, 347 *W.* 16*th South, Salt Lake City* 10, *Utah.*

Water Tempering Valves for Hot Water Supply Systems

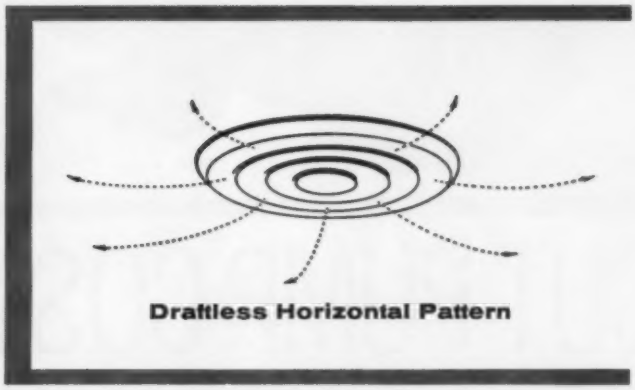
Bronze tempering valves for large hot water supply systems available in various capacities. A 1 in. size passes 31 gpm, and a 1½ in. size 44 gpm, with a pressure drop of 10 psi. Five sizes available with interchangeable thermostats. Literature sent on request. — *Watts Regulator Co.,* 10 *Embankment Rd., Lawrence, Mass.*

Rubber Expansion Joint for High Pressure Applications

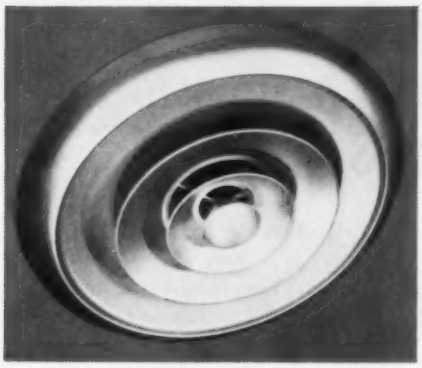
Anti-migration rubber expansion joint has metal reinforcing rings that remain stable under pressure. Withstands vibration and high temperatures and can handle corrosive materials. Available in a variety of constructions. — *United States Rubber Co.,* 1230 *Ave. of the Americas, New York* 22, *N.Y.*



Direct Downward Discharge



Draftless Horizontal Pattern



ANEMOSTAT C-4 Adjustable Air Diffuser GIVES YOU BOTH

The Type C-4 Anemostat Air Diffuser provides controlled variable air distribution. The snap-on inner-assembly of this adjustable unit may be easily raised or lowered, thus varying the air pattern from draftless horizontal to a direct downward discharge.

You can install the Type C-4 Anemostat Air Diffuser on exposed ductwork or flush to the ceiling. In fact, you can plaster right up to the take-off duct. The unit is excellent for use adjacent to surface-mounted light troffers. The outer cone of the diffuser is designed to minimize "smudging," reducing cleaning and repainting expenses.

Write for Catalog CI-70, which gives complete information on all Anemostat Circular Air Diffusers.

ANEMOSTAT®

ANEMOSTAT CORPORATION OF AMERICA
10 East 39th Street, New York 16, N. Y.
Representatives in Principal Cities

AC 1380

TYPE GP
CLOSE-COUPLED
CENTRIFUGAL

CUT PUMP COSTS

USE AURORA CENTRI-PAC PUMPS

CAPACITIES TO 400 GPM / HEADS TO 150 FEET

NOW AVAILABLE IN 11 PACKAGED SIZES

AIR CONDITIONING EQUIPMENT / CIRCULATING SERVICES / GENERAL SERVICES

- LOWER IN COST . . . made possible by standardization of most popular sizes packaged and stocked for immediate off-the-shelf shipment.
- EXTREMELY COMPACT . . . close-coupled design saves valuable space and is more easily installed.
- HIGHLY EFFICIENT . . . low horsepower requirement means less initial cost and lower operating expense.
- EASILY MAINTAINED . . . pump can be completely disassembled for inspection and repair without disturbing the piping.
- QUALITY CONSTRUCTION . . . bronze fitted, mechanical seals, drip-proof NEMA rated motor with stainless steel shaft and built-in overload protection, and cast bronze impeller keyed and locked in position.
- SMOOTH, QUIET OPERATION . . . low NPSH meets critical suction conditions.

You may also select from a complete line of horizontal or vertical mounted pumps and flexible-coupled pedestal-mounted pumps engineered to your specific requirements.

WRITE FOR BULLETIN 117 PKG

AURORA Always PUMPS

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LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

EQUIPMENT DEVELOPMENTS
Continued

Centrifugal Fans For Industrial Service

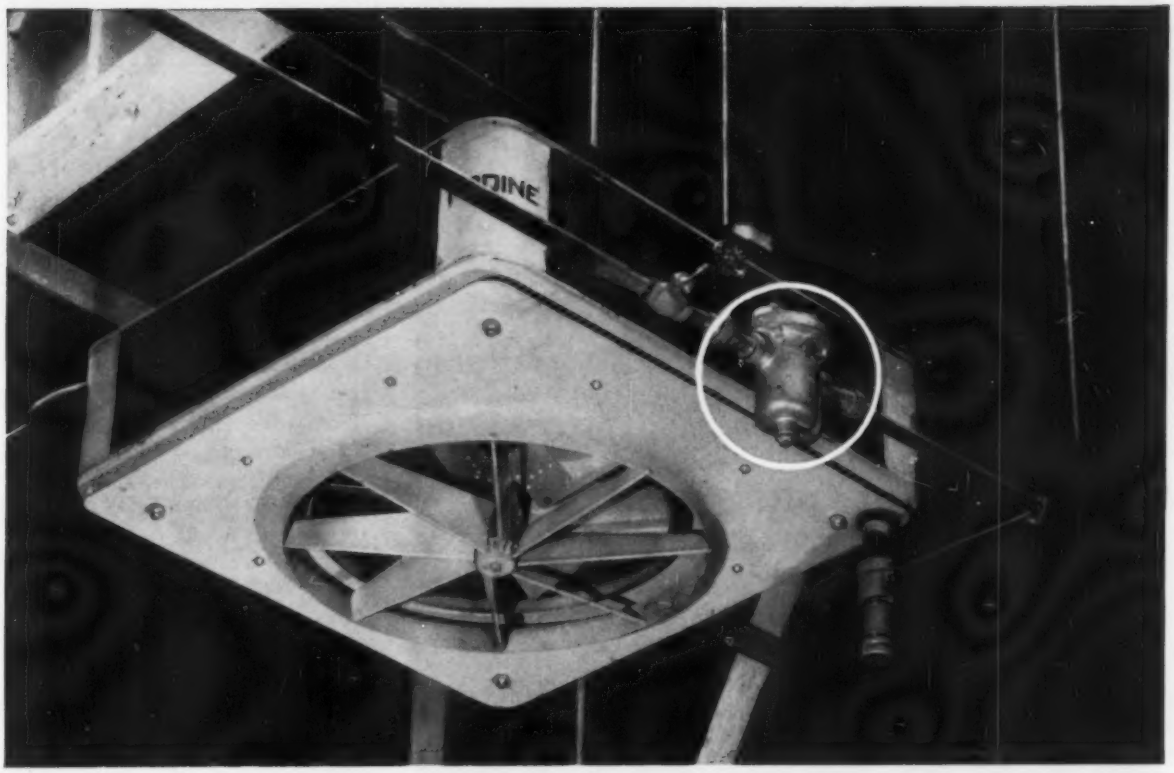
Forward curved centrifugal fans for heavy duty industrial service available in two basic models. One unit for 300 F maximum operating temperature; the other for temperatures up to 2000 F. Latter unit for direct installation in furnaces, ovens, kilns, and dryers, without external ductwork. Standard wheel sizes from 7½ to 73 in. in diameter for belt drive or direct connection. Gas-tight, corrosion-resistant, or spark-resistant models also available. Optional equipment includes discharge dampers, outlet and inlet flanges, access doors, drain connections, and others. — *Garden City Fan & Blower Co., 801 N. Eighth St., Niles, Mich.*

Small Thermohygrograph Can Be Used for Field Work

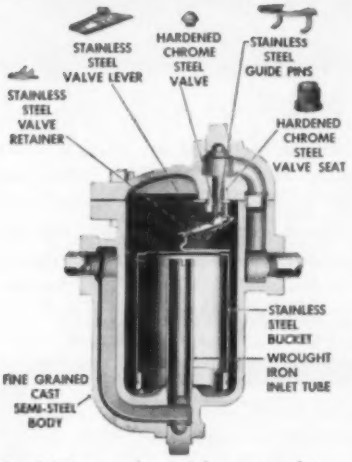
Temperature and humidity recorder for testing air conditioning systems and other applications. Can be furnished with 24 hr, 7 or 14 day clockworks in various temperature ranges. Case size is 8½ × 4 × 4 in.; weight is 3½ lb. Bulletin sent on request. — *Kahl Scientific Instrument Corp., P.O. Box 1166, El Cajon, Calif.*

Electric Defrosting Element For Snow and Ice Removal

Electric metal-sheathed defrosting element for clearing snow and ice from asphalt, macadam, and concrete surfaces. Will withstand the 300 F temperatures present when installed in hot-pack asphalt. Available in 24 ft, 400 w lengths, and 40 ft, 675 w lengths, both operating on 240 v. — *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*



How Corrosion of Unit Heaters is Prevented by Good Trapping


STAINLESS STEEL VALVE LEVER
HARDENED CHROME STEEL VALVE
STAINLESS STEEL GUIDE PINS
STAINLESS STEEL VALVE RETAINER
HARDENED CHROME STEEL VALVE SEAT
STAINLESS STEEL BUCKET
WROUGHT IRON INLET TUBE
FINE GRAINED CAST SEMI-STEEL BODY

Good design, good materials mean good trapping with Armstrong Traps for unit heaters.

Cause. Costly corrosion of unit heaters is frequently the result of sluggish condensate drainage and inadequate venting. Any carbon dioxide gas present in the steam supply will go into solution if the condensate is below steam temperature, forming corrosive carbonic acid. Presence of oxygen aggravates the corrosion.

Remedy. Armstrong traps prevent carbonic acid formation because they discharge condensate *at steam temperature* and vent CO_2 and air at the same time. There is never any accumulation of condensate and incondensible gases to cause trouble as can occur with traps that must wait for condensate to cool before they will open.

Trap Selection. It is important that the traps be correctly sized, with a generous safety factor to provide adequate air handling capacity. Armstrong sizing recommedations are thoroughly reliable, being based on actual performance of the traps under operating conditions rather than on theoretical considerations.

Complete Details. Ask for Armstrong Bulletin No. 252 which tells how to select and install traps for any type of unit heater. For your free copy, call your local Armstrong Factory Representative, or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

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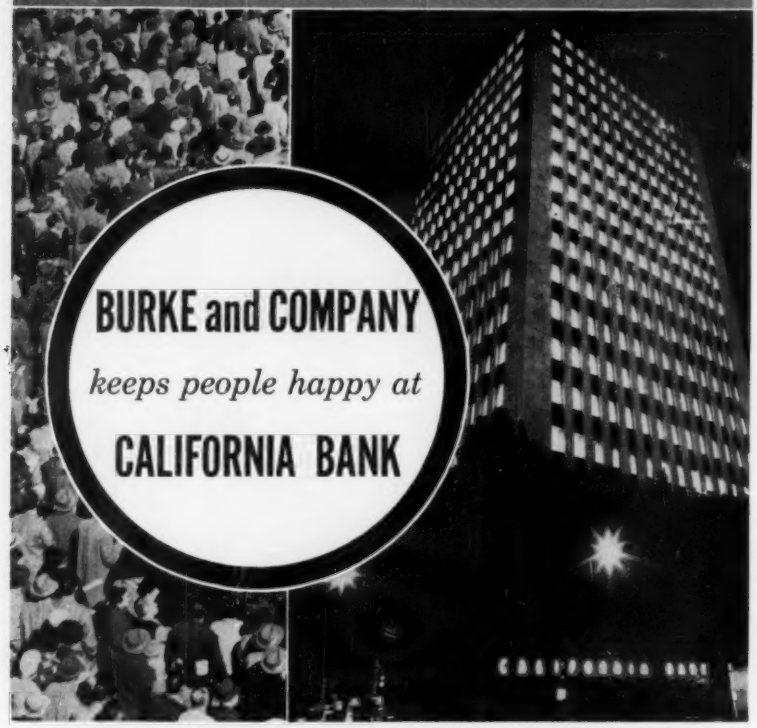
8747 Maple Street, Three Rivers, Michigan

"See Our Catalog in Sweets Industrial Construction File"

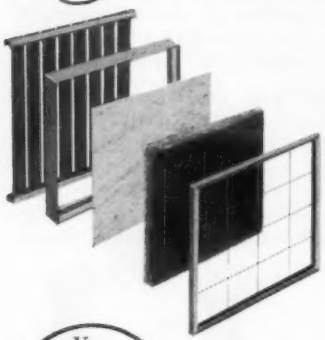
Where people gather...CLEAN PURE AIR is VITAL



ARCHITECT — Claud Beelman & Associates • GENERAL CONTRACTOR — C. L. Peck Construction & Realty Co. of Los Angeles • AIR CONDITIONING CONTRACTOR — Air Conditioning Company • MECHANICAL ENGINEERS — Kilpatrick & Company.

● Good customer relations require an atmosphere of clean, pure air for both patrons and employees. That's why in the new California Bank Building in Los Angeles ROTO AIRE replaceable media air filters, as well as both total and partial detention type gas and vapor adsorbers by Burke are being used.

ROTOAire® FILTERS STOP AND HOLD DIRT!
ACTIVATED CHARCOAL FILTERS PURIFY AIR!



Here are advance design air filters and air purifiers that are highly efficient, effective and dependable.

They are readily adaptable to all new or existing installations.

They are available in a wide variety of sizes.

They may be operated at varying velocities and with various combinations of media.

The initial cost is low, but even more important . . . the maintenance cost is low.

You can specify ROTOAire® PRODUCTS with confidence!

Write for Technical Data Bulletin and "Economic Analysis."

Selected Territories Available For Qualified Representatives

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2902 Hyde Park Blvd., Los Angeles 43, California

EQUIPMENT DEVELOPMENTS

Continued

Heat Exchangers Feature Removable Bundles

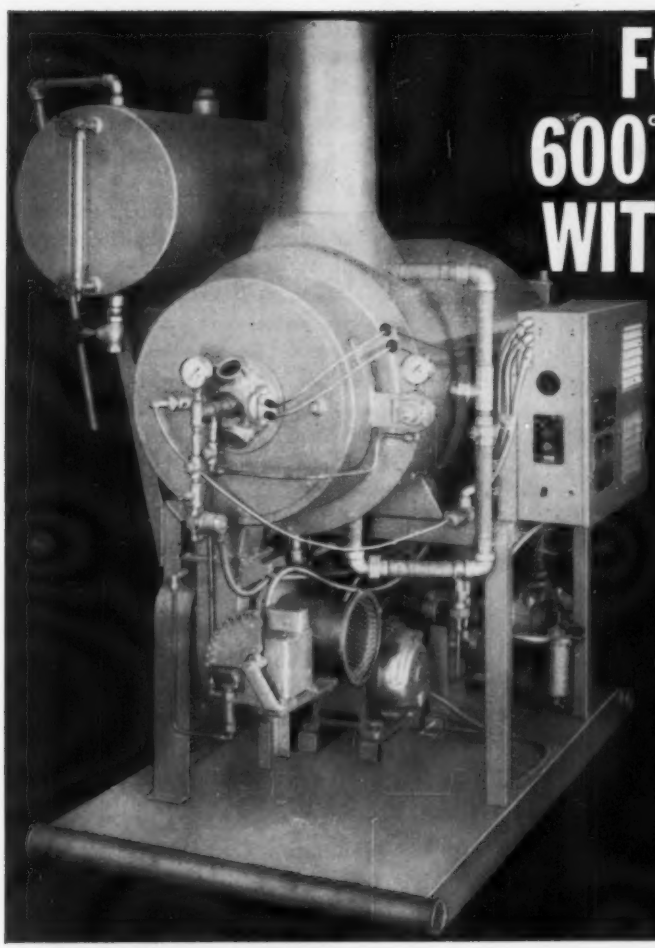
Heat exchangers feature removable bundles with floating head clamp-ring design for applications where frequent cleaning of the tubes is necessary and/or thermal differential expansion between the shell and tubes becomes a problem. Will handle any combination of liquids and gases, including those that are toxic, volatile, or flammable. May be used as heaters, coolers, condensers, or vaporizers. Available in 19 shell sizes from 6 through 42 in. and with any practical tube length in two, four, or six pass arrangement. — *American-Standard Industrial Div., Detroit 32, Mich.*

Evaporative Condensers In 5 to 50 Ton Capacities

Evaporative condensers built on special order will include coils made of prime surface copper tubing, centrifugal fans, and an integral water pump and float control. Cabinet will be a heavy duty enclosure with formed corner posts and recessed panels. Information sent on request. — *Halstead & Mitchell Co., Bessemer Building, Pittsburgh 22, Pa.*

Replacement Motors for Window Air Conditioners

Fractional horsepower electric motors for replacement of units in window air conditioners using square-type mountings. Six-pole shaded motors have a horsepower range of 1/10 through 1/6. Available in single-speed and two-speeds, 115 and 230 v, 1050 rpm. Information sent on request. — *Redmond Co., Inc., Distributors Div., Owosso, Mich.*



FOR 600° TEMPERATURES WITHOUT ANY PRESSURE!

VAPOR MODULĀTIC

HI·R·TEMP

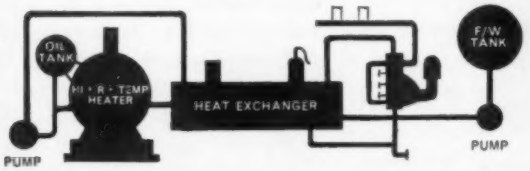
LIQUID PHASE HEATER

This Vapor Modulātic HI·R·TEMP Liquid Phase Heater uses heat transfer aids to provide dependable, automatic, accurately controlled heat transfer to 600° F., without high pressures. Burns natural gas, propane, butane, No. 2 diesel oil, or kerosene. Sizes to 13,000,000 b.t.u.

Check these advantages:

- ACCURATE TEMPERATURE CONTROL. Modulāting controls automatically maintain pre-determined temperature of heat transfer oil.
- NO WATER TREATMENT NEEDED. Eliminates cost of treatment system. No corrosion, scale, freezing problems.
- POSITIVE OIL FLOW. Rotary gear pump assures uniform circulation...prevents hot-spots, coking, sludging, oil breakdown.
- LOW INSTALLATION COST. Completely unitized, skid-mounted with all piping in place. Factory tested before shipment. Compact, lightweight...install it anywhere.
- LOW-PRESSURE VESSELS AND FLOW CIRCUITS. Saves the cost of heavy-duty piping, fittings, valves.
- COLD OIL SEAL. Expansion tank is uninsulated and isolated from main flow of hot transfer oil. Protects oil against atmosphere, sludging, deterioration.
- OPTIMUM SAFETY. Non-toxic. Built to ASME codes. Flame failure, low oil level, high temperature safety shut-off controls are standard. CO_2 quenching ring optional.
- LOW OPERATING COST. Forced-draft combustion, coiled tube design is highly efficient. No high pressures, does not require licensed engineer to operate.

here's how one vapor Hi·R·Temp, with heat exchangers, can supply your needs for processing, heating, hot water, etc.



Heated oil from HI·R·TEMP (at temperatures to 600° F.) passes through heat exchangers to provide steam for processing; at 450° for steam for heating plant and office; at 200° for hot water for cleaning, washing, other uses. Provides full, economical use of heat to lower your operating costs!

VAPOR

For complete information, send coupon today.

Vapor Heating Corporation, Dept. 21-F
80 East Jackson Boulevard, Chicago 4

Please send me Bulletin 4023 on your HI·R·TEMP Liquid Phase Heater.

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Company_____

Address_____

City, Zone, State_____

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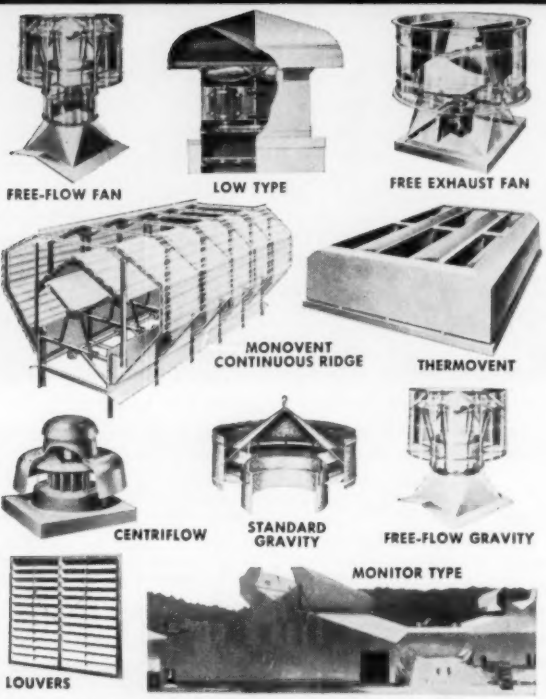
WALL LOUVERS



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BURT'S complete ventilator line includes a type and size to put air to work most efficiently and economically for your specialized needs. BURT'S engineering skill and know-how from more than half a century designing and building ventilators is your assurance of satisfaction. Your inquiry will receive prompt and qualified attention.

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EQUIPMENT DEVELOPMENTS

Continued

Automatic Control, Indicator For Sump Pump Application

Automatic control and liquid level indicator for use with submersible and vertical sump pumps and other applications. "Vis-A-Trol" control system combined with a depth measuring device that shows depth of liquid in pit. Pumping rate compared with in-flow and indicated on instrument. Responds instantly to level changes in sump. Can be installed inside buildings up to 300 ft from pit. No electrical connections needed between pit and control panel. Panel and instrument is a factory-wired unit including starters, alternators, and high water alarms. Bulletin AC-100 sent on request. — *Weil Pump Co., 1514 N. Fremont St., Chicago 22, Ill.*

Chemical Compound Kills Algae in Cooling Water

Compound kills algae and odor in cooling tower spray ponds and other industrial water. Supplements firm's other chemicals for algae control. — *Stiles-Karlsonite Corp., 1550 Grand Ave., Waukegan, Ill.*

Pipe Insulation Jacket Is Flame-Retardant

White embossed flame-retardant vapor-barrier jacketing for pipe insulation has U.L. flame rating of 25, and complies with the NBFU Index 90A and 90B. Does not wrinkle under high humidity conditions, or turn yellow with age. Three-ply construction reinforced in lamination with glass fiber yarn on 1/6 in. centers in both directions. Water permeability rate is 0.01 perms. Information sent on request. — *Johns-Manville, Industrial Insulations Div., 22 E. 40th St., New York 16, N.Y.*

NEW NON-COMBUSTIBLE VAPOR BARRIERS ARE SELF-EXTINGUISHING!

Installing Pyro-Kure-faced insulation over air-conditioning ducts.

Part of our business is manufacturing vapor barriers — to stop moisture and prevent condensation. A problem: produce a superior vapor barrier that is *non-combustible*. We've done it! Called *Pyro-Kure*, it is available in rolls of various widths and in many combinations — foil, paper, plastic film. They can be reinforced for amazing strength. There is no other vapor barrier like it on the market. It is the first and only *permanent* non-combustible vapor barrier with an unqualified U/L flame spread rating.

Pyro-Kure now makes it possible for these specifications to be fulfilled: *a vapor barrier with a permanent flame spread rating: kraft side-25; foil side-5*. It is now being used by leading insulation manufacturers for insulation facings, pipe jacketing, duct lining.

If you or your firm is interested in the concept of "total fireproofness" in construction, you will want to know more about this development. Pyro-Kure self-extinguishing vapor barriers may have a use in a current project. Write American Sisalkraft, Attleboro, Mass. for a complete file of data, facts, figures and samples. No obligation.

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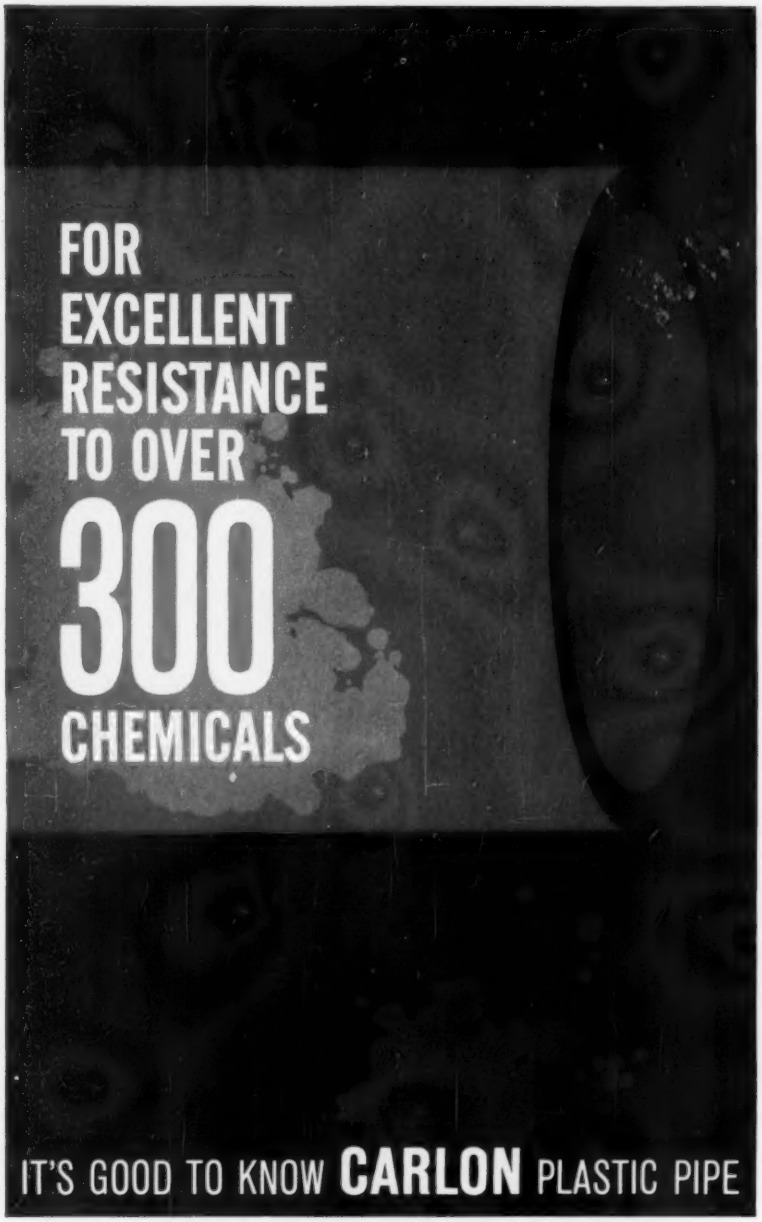

To help you make major pipe savings . . . Carlon's new Plastic Pipe Fact-pak. Includes chemical names, solution-strengths, operating temperatures and pressures. *Write for yours.*

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Please send me the new Plastic Pipe Fact-pak.
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EQUIPMENT DEVELOPMENTS

Continued

Electric Duct Furnace Supplies Supplemental Heat

Unit provides supplemental heat for heat pump systems and long heat runs of any type; as a reheat unit in dehumidifying systems; and to heat dry air in industrial and other systems. Available in 10, 15, and 20 kw sizes producing 34,150 to 68,330 Btu per hr. Can be installed horizontally or vertically. Heat elements are black chrome sheathed for protection in corrosive atmospheres. Positive step control prevents more than 5 kw coming into service at any one time. Available in 440 and 230 v, three phase, and in 230 v two wire systems. Can be controlled by a 24 v room or duct thermostat. — *Wesco Furnace Div., Northwest Foundry & Furnace Co., 2345 S.E. Gladstone St., Portland 2, Ore.*

Temperature Probes For 1000 F Measurements

Temperature probes have a thermocouple element shielded by concentric shields inside a ¼ in. protective tube with inlet and outlet slots. Measures gas at temperatures over 1000 F and velocities over 300 ft per sec. Information sent on request. — *United Sensor & Control Corp., P.O. Box 149, Glastonbury, Conn.*

Hydronic Baseboard Has Built-In Damper

Hydronic baseboard has integral built-in damper as standard equipment. Damper snaps into place on a hanger bracket without cutting or fitting. Adjusted to fully open or fully closed by movement of fingers. — *Continental Manufacturing Co., P. O. Box 4048, Baltimore 22, Md.*

ANOTHER COLLEGE COMFORT-CONDITIONS THE MARLO SEAZONAIRE WAY!

WEST HALL, STEPHENS COLLEGE
Architect:
Murphy & Mackey, St. Louis
Engineer:
Paul Londe & Associates, St. Louis
Contractor:
R. W. Vaught, Columbia, Mo.

These remote room air conditioning units for year-round comfort are at home in any surroundings. Here's an installation at Stephens College, a fashionable school for women at Columbia, Mo., where two new residence halls were completely comfort-conditioned with 126 Seazonaires. Notice how the rounded styling and attractive finish blend harmoniously into the bedroom decor.

Seazonaires provide an immensely practical approach to multi-room buildings like this. They're easy to install, needing only simple piping for chilled or heated water. They operate quietly, and can be regulated individually by the occupant of the room or suite.

See the Marlo representative in your area for complete information on the construction and performance of Seazonaires, or write for our illustrated Seazonaire brochure.

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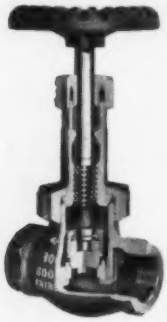
TO LEARN WHY MEN WHO KNOW VALVES AGREE THAT FAIRBANKS VALVES LOWER MAINTENANCE COSTS AND GIVE LONGER SERVICE, EVEN UNDER THE MOST DIFFICULT OPERATING CONDITIONS.



Full-Port 200 Brinell Nickel Alloy Radial Disc and Seat.
Fig. 0541—Globe, Fig. 0543—Angle, Sizes ¼ thru 2 inches. Made to give full flow on high pressure, high temperature steam, water, gas, oil and air lines.

Full-Port 500 Brinell Stainless Steel Plug Disc and Seat.
Fig. 0545—Globe, Fig. 0547—Angle. Sizes ¼ thru 2 inches. Designed for full flow when fully opened and for severe service of throttling and frequent operation.

Throttle-Port 500 Brinell Stainless Steel Cone-Plug Disc and Seat.
Fig. 0551—Globe, Fig. 0553—Angle. Sizes ¼ thru 3 inches. Recommended for most severe service and where constant throttling is required.

Service: 300# Steamworking pressure at 550° F.; 600# Cold Water, Oil or Gas Pressure—Non Shock.

Fairbanks features: Two-Piece Radial Seat Union Bonnet, a true ball and socket connection assures a tight seal time and again and facilitates the removal of the bonnet assembly for the regrinding or placement of the disc and seat. Bottom-seated Seat Ring has tight seal on pressure side. Valves may be repacked under pressure when wide open. Protected Top Seat, above stem threads and out of stream flow, makes a tight seal when valve is full open. All parts of three valves may be interchanged size for size and type for type.

Buy Through Distributors. Fairbanks products are stocked, sold and recommended by leading distributors in all the principal cities across the nation.

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EQUIPMENT DEVELOPMENTS

Continued

Centrifugal Pumps Have Renewable Liners

Pumps for boiler feed, condensate return, transfer, and circulation applications. Discharge is 150 psi water gage; suction 30 psi WG; stuffing box 75 psi WG; and temperature to 210 F. Includes renewable liners for quick field repair, and a drip-proof bearing housing which insures against bearing failure. Heavy stainless steel shaft is guaranteed 10 years against breakage. Selection and performance data sent on request. — *Roy E. Roth Co., Turbine Pump Div., Rock Island, Ill.*

Zinc Anode Plug Assemblies For Heat Exchanger Service

Units for water protection in all types of heat exchangers. Made of electrolytic zinc in a wide range of diameters and lengths, all fitted with standard steel or brass pipe plugs from ½ to 1 in. Can be used in heat exchanger systems with pressures up to 200 psi water gage. Available with weep holes if desired. Specification sheet sent on request. — *Butler Engineering Associates, Inc., Equipment Div., 746 Ramsey Ave., Hillside, N.J.*

Layout Tool Has Accuracy To Plus or Minus 0.005 In.

Layout tool for use in scribing straight lines or circles for the sheet metal, welding, and metal fabricating industries. Setting locked into place until released. Available in 12, 18, and 24 in. rod sizes. Information sent on request. — *O'Brien Engineering Co., Manufacturing Div., South Beloit, Ill.*

What it is

The business end of a powder-actuated tool, made by Ramset Fastening System. It's called the Duo-Jobmaster.®

What it does

Makes fastenings to steel and concrete. You can attach furring strips to concrete in less time than it takes to tell about it. Or to steel. Sprinkler pipes too. And door bucks. Curtain wall brackets. Heating ducts. *Almost anything.*

The fastenings are made with male or female threaded studs. Or with drive pins (nails). Over 140 different fasteners are currently available.

How it does it

The fastener and a 22 calibre blank cartridge are inserted in the tool. A squeeze of the trigger and the fastener is in. This includes studs and drive pins that are over 4 inches long! Numerous interlocks prevent it from being operated prematurely. And easily interchangeable barrels convert it from ¼″ to ⅜″ work.

What it saves you

Time, money, effort. No time consuming drilling or plugging is required. There are no expansion bolts to insert. In some cases fastenings can be made every 15 *seconds*. Others take a little longer.

Five years of extensive use by contractors have shown that the fastenings made by this tool are at least the equal of those made by any other method. But it makes them faster and with vastly less effort. It's made by Ramset and it's the finest powder-actuated tool in existence.

Write for more information or call your local Ramset dealer. He's listed under "Tools" in The Yellow Pages.

WINCHESTER-WESTERN DIVISION Olin 291-F Winchester Ave., New Haven 4, Conn.

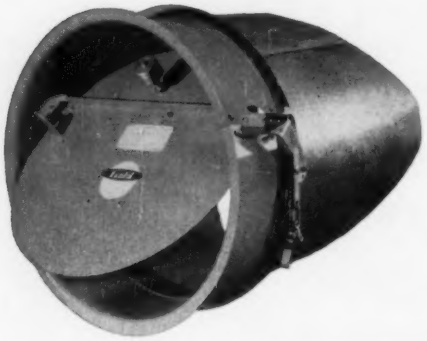
Don't design a

DRAFT SHORTAGE

into your

GAS BOILER

installations



Specify a double-acting

field

DRAFT CONTROL*

*With a Field the draft assistance of the chimney becomes available to the boiler for abundant draft at all firing rates, precisely controlled to the optimum twelve-to-one air-to-gas ratio recommended for clean, bright, efficient combustion. For 5″ through 34″ flue outlets. Write for specification data.

Specify Field Draft Controls for gas, gas-oil, oil or coal, for boilers, furnaces, incinerators, with natural, forced or induced draft, 5″ through 34″ flues.

FIELD CONTROL DIVISION

Conco Engineering Works, Inc., Mendota, Illinois

AFFILIATES: Spartan Tool Division — Powered Sewer Cleaning Equipment
Materials Handling Division — Cranes, Hoists
Conco Building Products, Inc. — Brick, Tile, Stone
Chicago Tramrail Division — "Trak-Rak" Stacker Cranes, Monorail Systems, "Fas-Lok" Storage Racks

EQUIPMENT DEVELOPMENTS

Continued

Control and Line Valves for Pneumatic, Hydraulic Service

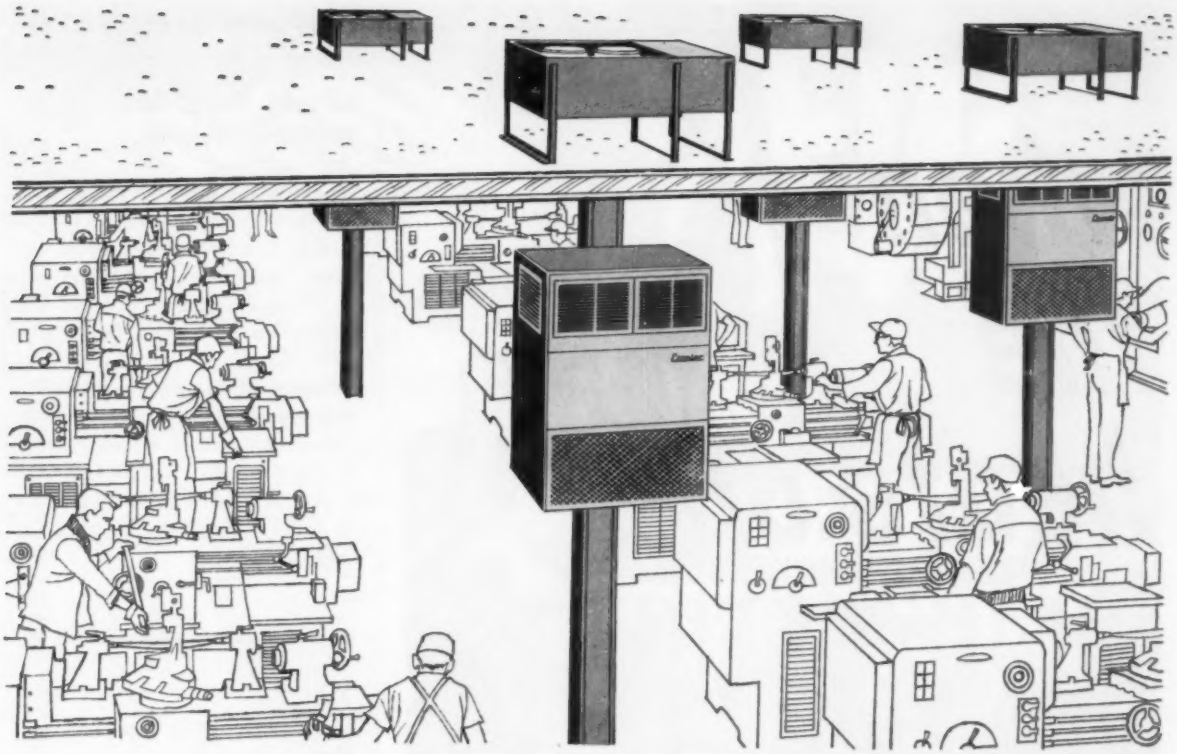
Control valves for 1500 psi pneumatic and hydraulic service and −40 to 250 F temperatures. Line valves for 1200 psi service with same temperature limit. Control valves made of basic valve, manifold block, and operating attachments. Basic valve available in 4-way, 3-way, 2-way, diverter, and shuttle cycles. Line valve is a uni-directional shut-off valve with an integral actuator. Bulletin 5000 sent on request — *Ledeen, Inc., 3350 N. Gilman Rd., El Monte, Calif.*

Permanent Air Filters in All Sizes, Two Thicknesses

Dry type permanent air filters are interchangeable with all standard sizes of disposable filters for original equipment, and can be installed on present equipment without modification. Unit cleaned with warm water. Filtering media made of finely divided plastic materials. Screens on each side of filter eliminate excessive lint. Units available in all standard sizes, 1 and 2 in. thicknesses. — *Air Filter Corp., 4554-P W. Woolworth, Milwaukee 18, Wis.*

Tube-to-Hose Fitting Does Not Require Adapter

Tube end hose fitting permits joining of tube directly to one end of hose assembly without the use of an adapter. Tube end incorporates "O-Ring Seal" fitting with separate grip and seal. Available for either double or single wire braid hose in sizes from 3/16 to 1½ in. ID with tube OD sizes from ¼ to 1½ in. Catalog sent on request. — *The Lenz Co., 3301 Klepinger Rd., Dayton 1, Ohio.*



Typical installation: Outdoor sections on the roof; indoor sections hung on columns.

New Carrier Heat Pump Weathermakers are practical even in colder climates

If you are planning or specifying the heating system for a new plant, or replacing a plant's heating system, the Carrier Heat Pump Weathermaker* is well worth considering as an investment that can save your client money. It is no longer true that climate is a deterrent to choosing a heat pump. The improved designs of these all-electric Weathermakers combined with the heat load from concentrations of light, machinery and people in industrial applications now make it possible to operate heat pumps as economically in colder climates as many types of conventional systems.

Besides operating economies, these heat pumps are space savers, too. The indoor sections of these versatile Carrier units may be suspended from the ceiling, hung on the walls, or they may stand on the floor. The arrangement shown above is for a one-story plant of about 30,000 square feet. The indoor sections are hung on columns to allow the freedom of four-way air discharge; the outdoor sections are installed on the roof. Other arrangements can be tailored to your own particular requirements.

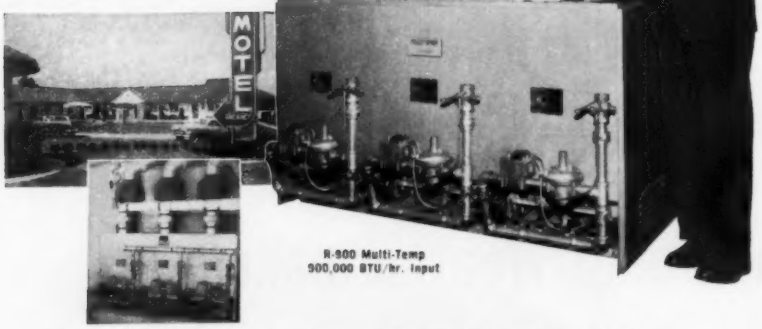
There are other dividends as well. Because it is all electric, soot, smoke, flame, fuel lines and storage tanks are eliminated from the heating system. Because it is also air-cooled, it requires no plumbing, water, or water towers. Because it is a one-system heating-and-cooling package, maintenance costs are cut. Fewer moving parts mean less servicing. And because a Carrier Heat Pump Weathermaker operates year-round, the normal expense resulting from seasonal startups and shutdowns is eliminated entirely.

Carrier manufactures a complete series of packaged heat pumps in addition to other air conditioning equipment. You can depend on your Carrier representative to make an impartial recommendation best suited for the job. Call him . . . he's listed in the Yellow Pages. Or write Carrier Air Conditioning Company, Syracuse 1, N. Y.

*Reg. U.S. Pat. Off.

Carrier Air Conditioning Company

when the heat's on



R-900 Multi-Temp
900,000 BTU/hr. Input

be sure it's

When the job's got to be right . . . at the right price . . . remember Hydrotherm!

Gas heat costs less than oil heat in big jobs (to 3,600,000 BTU/Hr) when you install Hydrotherm's MULTI TEMP hydronic system.

Sequence-fired combustion chambers permit automatic input modulation in accordance with load requirements — no short cycling — no override — built-in standby protection. Factory assembled . . . fits through a 2 ft. 6 in. door.

Easy to install, all cast iron, and guaranteed for 10 years . . . you can't miss with Hydrotherm.

Write for bulletin #HY-F107 and all the facts.

HYDROTHERM MULTI TEMP

Hydrotherm, Inc. • Dept. 13HP • Northvale, N.J.

EQUIPMENT DEVELOPMENTS

Continued

Butterfly Valves for Ventilation Systems

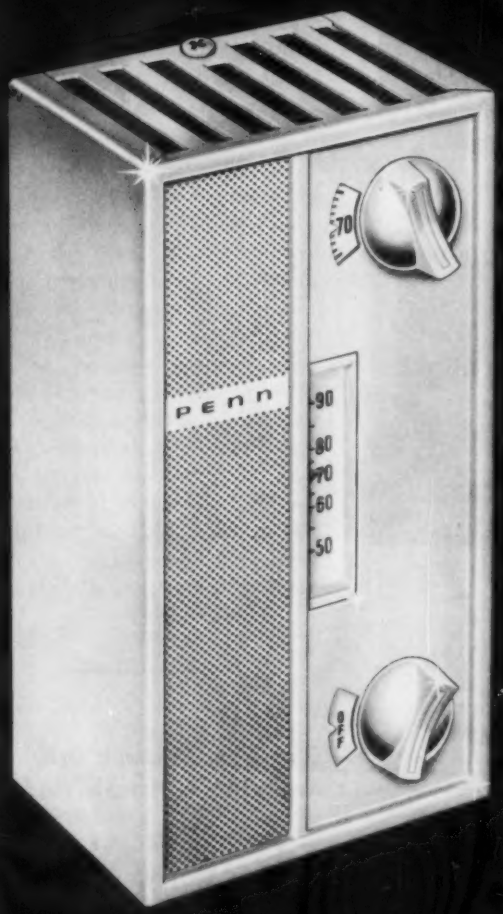
Control and shutoff butterfly valves for rectangular and flat oval ducts used in industrial and process ventilation and air conditioning. One-piece aluminum alloy body of small face-to-face dimension. Has replaceable rubber or synthetic resilient elastomer liner, against which an oval aluminum disc seats for tight closure. Controlled either manually or automatically. Available in sizes from 3 × 7 in. to 20 × 30 in. — *W. S. Rockwell Co., 300 Eliot St., Fairfield, Conn.*

Two-Stage Static Seal for High Temperature, Pressure

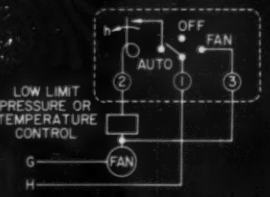
Unit has stainless steel V-ring preceded by a "Teflon" seal to operate at temperatures from −65 to 600 F under pressures up to 10,000 psi. Stainless steel ring maintains seal under extreme conditions; "Teflon" primary seal provides a "soft seat" for leakproof sealing. Units are reusable. Seal is highly resistant to corrosion and compatible with nearly all fluids. — *Pall Corp., 30 Sea Cliff Ave., Glen Cove, N.Y.*

Adapter Fittings Available As Tees, Elbows, and Crosses

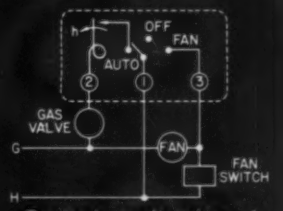
Fittings connect into any of firm's standard tube fittings without using intermediate lengths of tubing. Can be used to make complex manifolds. Tees and elbows can be perfectly aligned in the direction of the intended tubing runs. Available in sizes from 1/8 to 1 in. in machineable metals and plastics. — *Crawford Fitting Co., 884 E. 140th St., Cleveland 10, Ohio.*



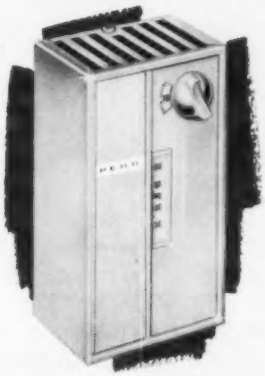
NEW UNIT HEATER THERMOSTAT



Typical application of Type 822A7 with AUTO-OFF-FAN selector on steam or hot water coil unit.



Typical application of Type 822A7 with AUTO-OFF-FAN selector on gas-fired unit heater.



Series 822, with or without function selector knob, rated for ¼ hp. service. Series 824, without function selector, is rated for 1 hp. service.

features easy-to-use, locking-type knobs for heating and summer ventilation

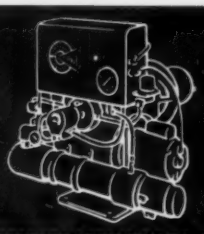
Here's the modern line-voltage thermostat with beautiful "slim-line" styling. Its built-in AUTO-OFF-FAN selector assures year 'round efficiency of unit heaters . . . saves fuel in winter . . . provides ventilation in summer.

It has easy-to-read temperature and function selector dials. It has exclusive, locking-type adjusting knobs, attached to cover but connected to adjusting shafts by factory-installed "keys" within the knobs. It has a built-in, concealed adjustable high limit stop for temperature dial. It has low operating differential at all voltages and amperages within its rating. It has easiest field wiring ever . . . simply connect to large terminals *on back of thermostat*. And, it has many more features you'll want. Learn more about this better thermostat for unit heaters . . . write to the Penn factory.

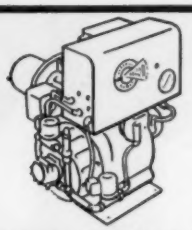
PENN CONTROLS, INC. Goshen, Indiana

EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

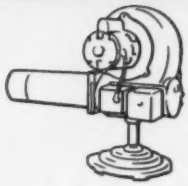
AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES



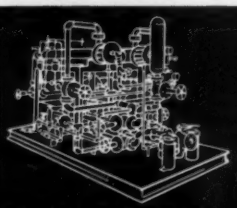
C-45 PRESSURE ATOMIZING OIL BURNER . . . forced or natural draft . . . for number 5 or lighter fuel oils . . . 7 models to 33 gph . . . UL approved. BULLETIN 100A



C-20 PRESSURE ATOMIZING OIL BURNER . . . forced or natural draft . . . for number 2 fuel oil . . . 7 models to 33 gph . . . UL approved. BULLETIN 102.



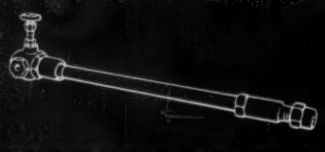
NAIROIL AUTOMATIC OIL BURNERS . . . for firing small steam or hot water boilers, etc. . . . 4 sizes available ranging from ¾ to 20 gph of number 2 fuel oil. BULLETIN 113B.



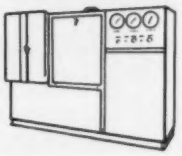
PUMPING AND HEATING UNITS . . . for problems involving heavy fuel oil for combustion. Single or duplex units from 2 to 100 gpm in standard or special models. BULLETIN 40.

We Make Them All!

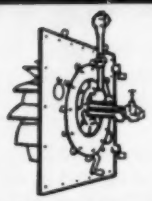
From National Airoil . . . you can obtain a complete line of top-quality oil burners, gas burners and related combustion equipment shown here. Check your needs . . . we'll be happy to supply you with engineering data and assistance. No obligation, of course.



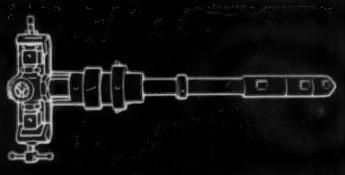
DUAL STAGE OIL BURNERS . . . for use when both mechanical and steam atomizing principles are incorporated in a single oil burner. 3 standard sizes. BULLETIN 25.



AUTOMATIC PACKAGED FIRING UNITS . . . Steam atomizing automatic firing units for oil and/or gas fuels. Standard unit capacities from 200 to 830 boiler horsepower (7,200 to 30,000 lbs of steam per hour). Larger units for special needs. BULLETIN 25.



UNIVERSAL REGISTER UNITS . . . a wide range of models including swing-type are available with capacities ranging from 60 to 500 gph. BULLETIN 51.



STEAM ATOMIZING OIL BURNERS . . . for use where steam or compressed air is available for firing many types of industrial process furnaces. 5 sizes have rated capacities from 10 gph to 725 gph. BULLETIN 23.

Established 1912
Incorporated 1917

NATIONAL AIROIL BURNER COMPANY, INC.

1284 E. Sedgley Avenue • Philadelphia 34, Pa., U.S.A.

Industrial Oil Burners, Gas Burners and Combustion Equipment

EQUIPMENT DEVELOPMENTS
Continued

Liquid Level Control Valve for Industrial Liquids

Unit has a ratchet and thumb screw connection on actuating arm and float rod holder to permit positioning of the float to obtain the correct liquid level. Lower end of valve plunger fitted with a heavy duty Neoprene screw-on washer to prevent leaks and chatter. A center "O" ring prevents seepage around the stem. Entire plunger is removable and replaceable. Made of cast bronze, valve has ½ in. inlet and outlet. Other sizes available on special order. Equipped with either 12 in. rod and float or chain and float. Bulletin LL-5998 sent on request. — *Mansfield Sanitary Inc., Perrysville, Ohio.*

Convertible Masonry Drill Available in Portable Model

Basic unit consists of a 2 hp continuous duty motor mounted on a portable tubular steel cradle, with flexible shaft and foot switch. A hand piece can be added to drill holes up to 2 in. in diameter; a drill stand can be added to drill holes up to 6¼ in. in diameter. A larger motor is available if larger holes are desired. Information sent on request. — *Clipper Manufacturing Co., Suite* 154, 2800 *Warwick, Kansas City* 8, *Mo.*

Pipe Sealer Available In Plastic Squeeze Bottles

Pipe sealer available in plastic squeeze bottle makes a permanent, leakproof, flexible seal. Used without thinning, sealer is insoluble in refrigerants, LP gas, gasoline, oils, kerosene, and chlorinated hydrocarbons. — *Madden Brass Products Co., P.O. Box* 444, *Aurora, Ill.*

DEKORON POLY-COR *Instrument Harness specified for new* GENERAL TELEPHONE COMPANY *building*

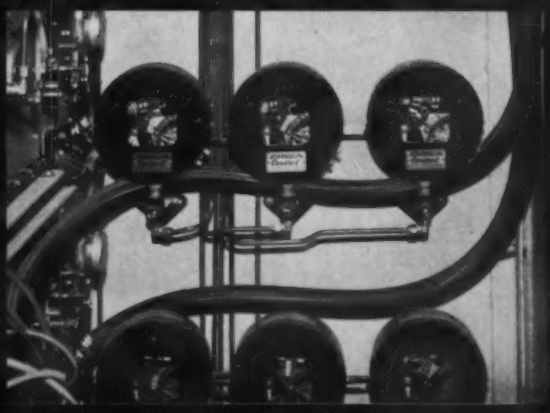
Architect Engineer: Steven Berkey Co. • *Air Conditioning Contractor:* F. B. Gardner Co.
Air Conditioning Controls Contractor: Johnson Service Co.

Typical of the swing to new Dekoron Poly-Cor all-plastic instrument harness for air conditioning control lines is the new General Telephone Company building at Pomona, Calif.

Poly-Cor is the most advanced instrument line harness made . . . now offers features never before available. New all-black polyethylene for higher temperature operation . . . number coded tubes for faster, easier installation . . . Mylar® vapor barrier. All these features are now standard in new Poly-Cor at no increase in price.

For faster, neater tubing bundle installations, check your local Dekoron products representative. Dekoron products are application-engineered by the company with the greatest application experience.

Rear view of central control panel, located over 600 feet from air conditioning equipment, shows neat installation of Poly-Cor which can be strung like electric wiring without complicated tube bending problems.

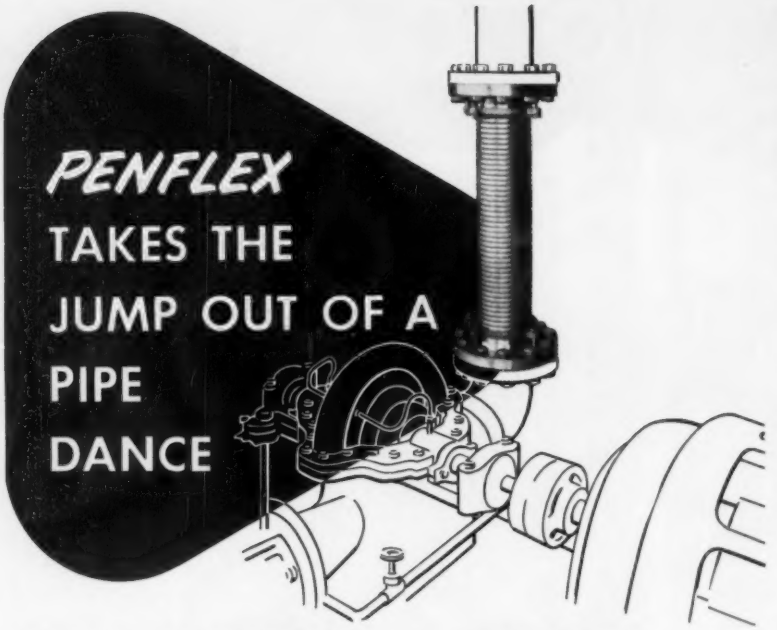


Dekoron® products

quality • research • service

SAMUEL MOORE & COMPANY

DEKORON PRODUCTS DIVISION • **MANTUA, OHIO**



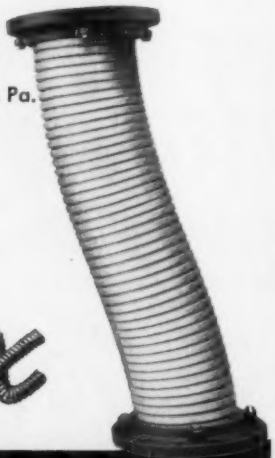
DAMPENS VIBRATION . . . CORRECTS MISALIGNMENT . . . ABSORBS EXPANSION

When the lines get the jitters, the units get the breaks throughout the system. That's where a Penflex flexible connector should be installed.

These "Job-Proved" flexible connectors have been developed to soak-up the vibration in the refrigeration, heating and air conditioning lines in commercial and industrial installations. They correct the misalignment of pipes caused by pump or compressor motion and prevent pipe cracks and system breakdowns. As the lines become hotter or colder the Penflex connector expands or contracts . . . always assures a tight system with peak operating efficiency.

Flexible connectors, vibration dampeners, flexible lines have all been developed . . . thoroughly pre-tested by Penflex . . . and "job-proved" throughout the industry to be unsurpassed for trouble-free operating efficiency.

If you want your system to operate at its very best specify Penflex for flexibility at all temperature zones. Write for complete data to Pennsylvania Flexible Metallic Tubing Co., Paoli, Pa.



Penflex

TIGHT AS A PIPE . . . BUT FLEXIBLE

EQUIPMENT DEVELOPMENTS

Continued

Pressure Regulators Handle Water, Oil, and Air

High capacity pressure regulators available in 2, 2½, and 3 in. sizes with screwed ends, 150 lb flanged ends, and 300 lb flanged ends. Will handle water, oil, and air. Balanced-piston type unit made of bronze with bronze trim. Suitable for inlet pressures up to 400 psi and reduced pressures in two ranges: 10 to 60 psi or 50 to 125 psi. Maximum temperature is 150 F; higher temperature models available on special order. Bulletin E-56 sent on request. — *A. W. Cash Valve Manufacturing Corp., Wabash and Morgan, Decatur, Ill.*

Roof Top Air Conditioners Have 7½, 10 Ton Capacities

Units with 7½ and 10 ton cooling capacities have heating inputs of 150,000 and 300,000 Btu per hr, respectively. Approximate load per sq ft is 35 lb. Self-contained units are controlled with a single heating-cooling thermostat. Bulletin R3H sent on request. — *Curtis Manufacturing Co.*, 1905 *Kienlen Ave., St. Louis* 33, *Mo.*

Expansion Anchors Drill Own Hole, Then Expand

Self-drilling expansion anchors made of hardened steel are tapped for bolts or studs. Available in snap-off type for installation with power hammer, in flush type for hand hammer installation, and with tie-wire holes for all-around anchoring on construction and installation work. Eighteen sizes available. Information sent on request. — *Fastway Fasteners, Inc.*, 2157 *E. 28th St., Lorain, Ohio.*

NOW
THE FAMOUS "NO MAINTENANCE" PRESSURE REDUCING VALVE WITH NEW STEEL BODY

The Leslie GP-type pressure reducing valves are recognized as the simplest, most rugged, most maintenance-free ever made. Sold under Leslie's famous 3-year no-maintenance guarantee, they have so far been available with cast iron or cast bronze bodies only.

To satisfy the heavy demand for GP performance and construction features in 150, 300 and 600 lb. steel-body valves, here is the new Class GPS valve in carbon steel and alloy steels for steam, air, gas and other vapors.

The design still uses only two moving parts—a Spiroflex diaphragm and the main valve. These are virtually indestructible. There is nothing to wear out.

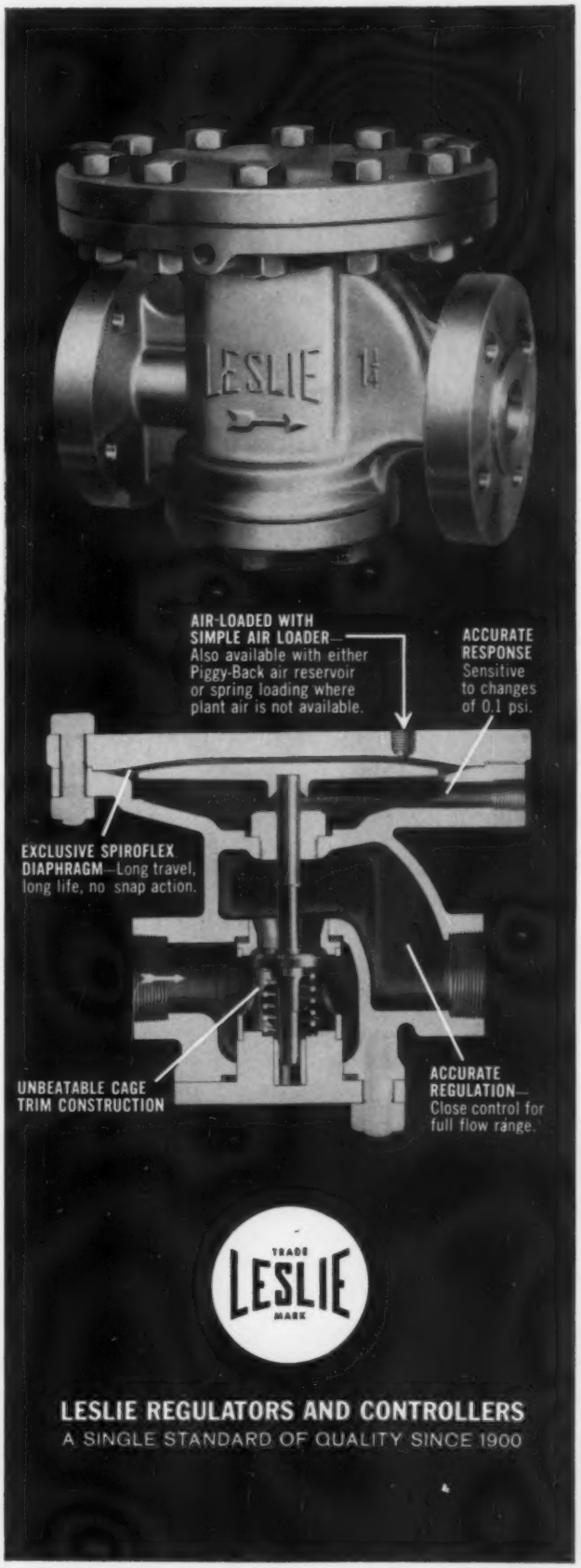
The low-stress diaphragm is the patented Leslie-Spiroflex®, which flexes like rubber but resists temperature as only a metal diaphragm can. Look at the cage trim construction—proved in Leslie-Lifetime control valves. Hardened stainless steel main valves seat on easily renewable, "permanent" type, stellited seat inserts. An unbeatable combination for long, trouble-free life.

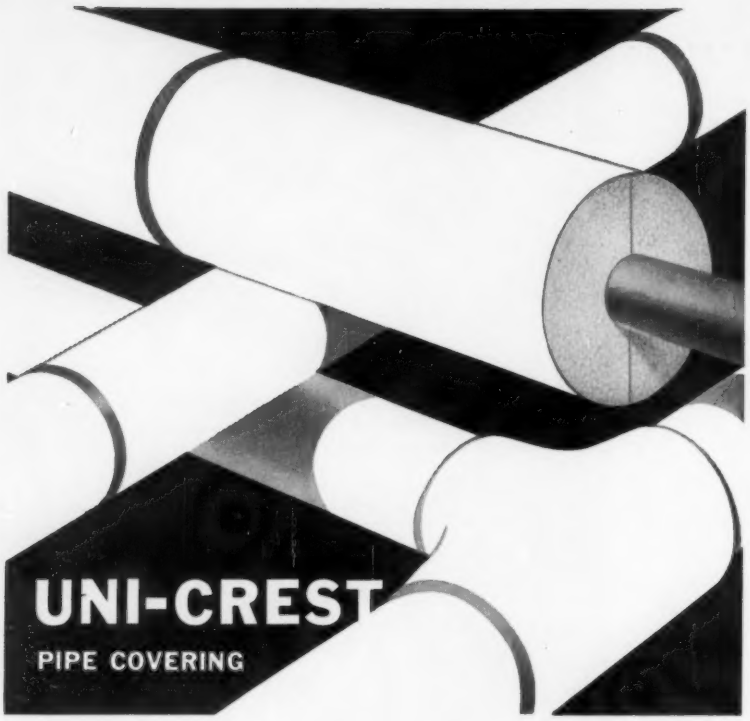
The man to show you how much money this design will save you is your nearest Leslie Engineer. He is listed in the Yellow Pages under "Valves" or "Regulators." You will also want to send for our Product Data Sheet No. 611.

SPECIFICATIONS—Reducing Valve, GPS Classes

Sizes: ½" to 2" screwed or welding ends, or 150 lb., 300 lb. and 600 lb. flanges in carbon steel and alloy steels. Inquire about 2½ to 4" sizes soon to be available.
Diaphragm: Leslie-Spiroflex®, Stainless Steel.
Main Valve: Type 440C Stainless Steel, hardened.
Seat Ring: Stainless Steel, Stellited.
Stem Guides: Gun Metal Bronze (top and bottom guided).
Main Valve Spring: Inconel.
Inlet Pressure Range: 600 psi, 600°F.
Reduced Pressure Range: 0-300 psig.
Minimum Pressure Drop across Valve: ½ psi.

Leslie Co., 703 Grant Ave., Lyndhurst, New Jersey


LESLIE
AIR-LOADED WITH SIMPLE AIR LOADER—Also available with either Piggy-Back air reservoir or spring loading where plant air is not available.
ACCURATE RESPONSE Sensitive to changes of 0.1 psi.
EXCLUSIVE SPIROFLEX DIAPHRAGM—Long travel, long life, no snap action.
UNBEATABLE CAGE TRIM CONSTRUCTION
ACCURATE REGULATION—Close control for full flow range.
TRADE LESLIE MARK
LESLIE REGULATORS AND CONTROLLERS
A SINGLE STANDARD OF QUALITY SINCE 1900



a new, economical, low temperature insulation

Uni-Crest expanded polystyrene pipe covering is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Its low thermal conductivity (K factor) plus its high resistance to water and water vapor — are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job.

Uni-Crest and self-extinguishing Uni-Crest are available in a wide variety of sizes and shapes. Both types are also available with or without a paper and foil laminate jacket.

For the address of the office nearest you, plus additional information and an actual sample, please write to the address below.

UNI-CREST DIVISION UNITED CORK COMPANIES
Since 1907

UNITED'S UNI-CREST EXPANDED POLYSTYRENE

1 Central Avenue, Kearny, New Jersey

BRANCH OFFICES OR APPROVED DISTRIBUTORS IN ALL KEY CITIES

EQUIPMENT DEVELOPMENTS

Continued

Zone Valves and Thermostats For Hydronic Heating

Two styles of valves for hydronic zone control: a straight-through type for multiple-pipe systems; and a diverting type for single pipe systems. Operated by shaded pole motor. Gear train made of "Delrin." Both motor and gear train are completely immersed in sound dampening, lubricating fluid and sealed in a metal case. Two companion thermostats also available. Both valves and thermostats are available in either two or three wire types. Folder R-1722 sent on request. — *White-Rodgers Co., 9797 Reavis Rd., St. Louis 23, Mo.*

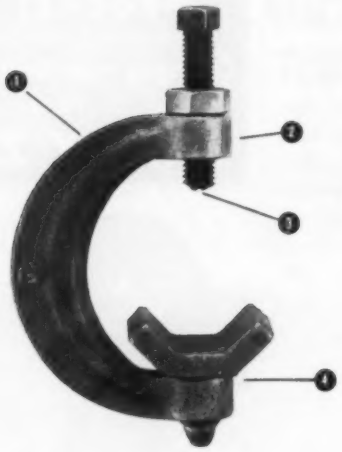
Gas Pressure Regulator In 4 in. Pipe Size

Unit for industrial low pressure service. Features cast iron and steel case construction. Has a maximum 5 psi operating pressure, with no structural damage at 25 psi emergency exposure. Also features "Straight-Thru-Flow" design. Seat coated to reduce friction. Bulletin sent on request. — *Maxitrol Co., 23555 Telegraph Rd., Southfield, Mich.*

Control Valve for High Pressure Liquids and Gases

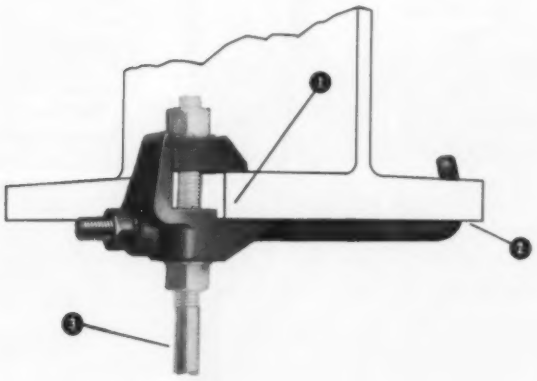
Split-body, barstock control valve for handling high pressure liquids and gases. Built to 2500 lb ASA Rating, and are suitable for 6000 psig cold working pressure. Available in steel and 347 stainless steel in both straight-thru and angle construction, sizes ½ through 1 in., with a variety of end connections. Seat ring lifts out. Data Sheet 103 sent on request. — *Conoflow Corp., 2100 Arch St., Philadelphia 3, Pa.*

You get extra features...at no extra cost ...when you specify Grinnell Beam Clamps!

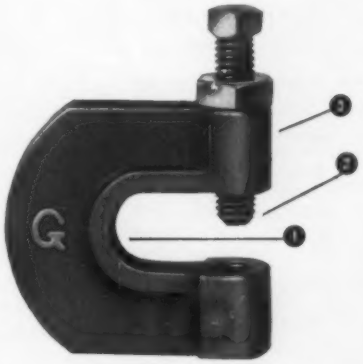


GRINNELL G-CLAMP HANGER, FIG. 92 — 1. Ribbed, malleable iron casting for greater strength, impact resistance. 2. Full thread engagement. 3. Hardened steel cup-point set screw for good "grip" on beam. 4. Saddle swivels 360°.

GRINNELL MALLEABLE BEAM CLAMP WITH EXTENSION PIECE, FIG. 229 — 1. Tie rod locks clamp in place when nuts are tightened. 2. One jaw size fits all beam flanges up to 7". 3. Malleable iron extension piece.



GRINNELL SIMPLEX SIDE I-BEAM CLAMP, FIG. 265 —1. 1¾" maximum jaw opening will take large beam flange thickness. 2. May be attached to beam of any flange width by merely ordering hook rod of suitable length. 3. Load ratings of 1,740 lbs.



GRINNELL G-CLAMP HANGER, FIG. 86 — 1. Ribbed, malleable iron casting for extra strength. 2. Hardened steel cup-point set screw for good "grip" on beam. 3. Full thread engagement — casting drilled and tapped for rod, set screw.

You get *more* Clamp for your money from Grinnell! Reason: Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive hangers that offer you much less.

Know what else you get with Grinnell Clamps? Wider choice of types and sizes! Better quality control! Published rating for *all* Clamps with a safety factor of at least 5 to 1! Faster delivery may be had from nationwide warehouses!

What's more, you always get dependable field service by trained Grinnell personnel . . . no matter how far from the job site the sale was made! Grinnell Company, Providence 1, Rhode Island.

Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports

Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, steel nipples, welding fittings, Grinnell-Saunders Valves, unit heaters — all made by

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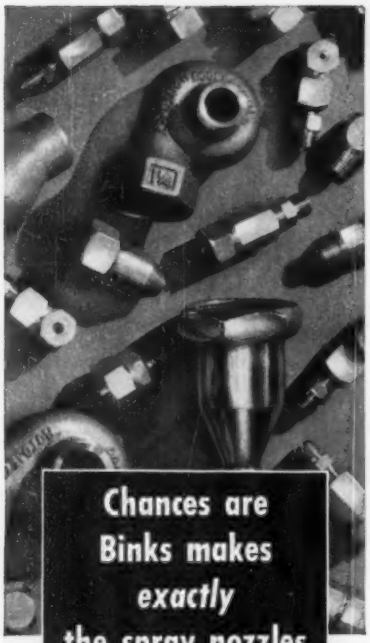

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for washing, cooling, processing, humidifying, dehydrating and hundreds of other applications.

Whatever your production or process requirements...you'll get the *right* spray nozzles quicker by calling Binks.

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EQUIPMENT DEVELOPMENTS

Continued

Safety Cut-Off for Electric Baseboard Heaters

Device on firm's electric baseboard heaters shuts off electric current in the event anything drops on heater. After a 50 F temperature drop, power is automatically switched on. Control cut-off is fixed at 195 F with a thermal differential of 50 F. Operates on current up to 277 v, 25 amp capacity. Information sent on request. — *Seaboard Products Corp.*, 191 *Frelinghuysen Ave., Newark, N.J.*

Temperature Regulators Available in Stainless Steel

Self-operated stainless steel units for handling corrosive or erosive chemical applications. Also suitable for steam, water, air, oil, and gas. Available in sizes of ¼, ⅜, ½, 1, and 1¼ in. Sliding gate seats are self-cleaning and self-lapping in operation. Units have a field removable thermal system for field change if necessary. Suitable for 300 psi WSP and 500 F. Eleven ranges available to control temperatures from 10 to 450 F. Information sent on request. — *OPW-Jordan*, 6013 *Wiehe Rd., Cincinnati* 13, *Ohio.*

Bimetal Disc Thermostats For −20 to 300 F. Service

Snap-acting, fixed-temperature thermostats have bimetal sensing disc that can be enclosed or exposed. Screw, solder, spade, formed, or elevated terminals available. Mounting features such as flanges, straps, etc. also selectable. Ratings depend on conditions of use. Technical data sent on request. — *Stevens Manufacturing Co., Inc., P.O. Box* 1007, *Mansfield, Ohio.*

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Adjustable
SPROCKET RIM
with Chain Guide
Changes that Danger Zone to a
SAFETY ZONE

—enables you to

ADD PLANT AREA

If re-aligning equipment will yield more working space, better production, lower costs—do it now. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
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- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

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169-B

STEAM SPECIALTY CO.

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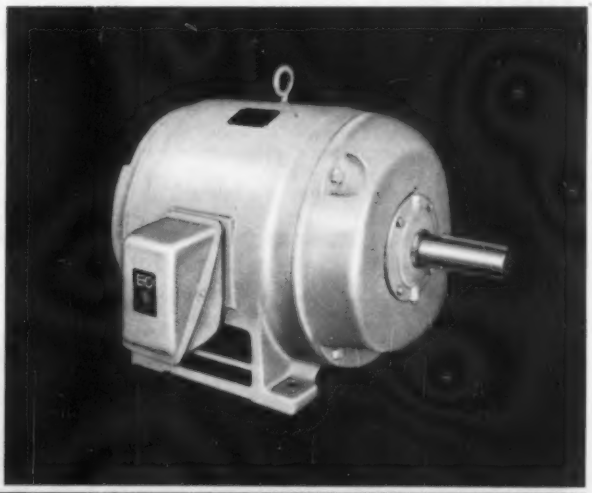
NOW, FOR THE FIRST TIME, PAY NO MORE TO GET "SILENT SERVICE" SPECIAL BALANCE MOTORS RIGHT OFF THE SHELF

ED "silent service" motors...like those developed for nuclear submarines...make far less noise because of less vibration.



Motor Frame Size	NEMA Standard Balance*	Electro Dynamic (1) Standard Balance*
182 – 256U	.0010 inches	.0005 inches
284U – 326U	.0015 inches	.00075 inches
364U – 405U	.0020 inches	.0010 inches
444U – 507W	.0020 inches	.0010 inches
580 and Larger	Contact Bayonne	

*Balance Figures are Peak to Peak measured as specified by NEMA

Electro Dynamic has done something about eliminating motor caused noise in heating, ventilating and air conditioning systems.

Through its work in developing super-silent motors for use in nuclear submarines, ED has been able to develop techniques that have been applied to production line motors with a resultant reduction of vibration levels. This advance has paid off not just in noise reduction, but also in longer bearing life and less maintenance.

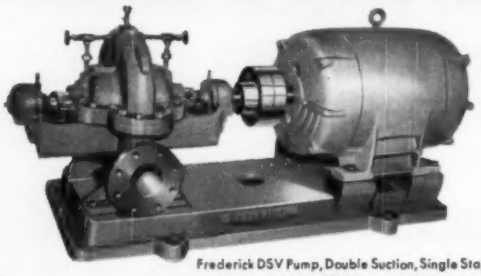
If you have requirements for motors rated between 1 and 800 hp, you can take advantage of this Electro Dynamic progress. As the table above shows, you can select ED motors with 100% better than NEMA standard balance at no extra cost. If you need still greater precision (promising lower noise) ED offers you 500% closer tolerance than NEMA standard balance at only slight extra cost. And even at 1000% better than NEMA standard and above, you can still get the "silent service" motor you need without paying the kind of custom-like costs you might expect.

These new SILENT SERVICE motors are available now. Write for details to:

ELECTRO DYNAMIC BAYONNE, NEW JERSEY
A DIVISION OF **GENERAL DYNAMICS** GD

FREDERICK CENTRIFUGAL PUMPS

for Air Conditioning, water supply, drainage and fire protection.



Frederick DSV Pump, Double Suction, Single Stage
Available in 1½" through 24" discharge

CUSTOM-BUILT FOR EFFICIENT, DEPENDABLE SERVICE

Whatever your air conditioning or other pump needs, you can choose from a complete line of Frederick Centrifugal Pumps—custom engineered and built for you. Exclusive features assure long service life under the most rugged conditions. In fact, many Frederick Pumps have been in service for over 40 years. Easy to install, easy to operate. Prompt repair service and parts available.

Write for Bulletin 104-A describing mechanical features, giving technical data.

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SILENT SWITCHING OPERATION

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EQUIPMENT DEVELOPMENTS

Continued

Commercial Thermostats Have Special Sealed Construction

Units enclosed in a polypropylene boot filled with epoxy resin to protect against moisture, fumes, or dust. Bimetal disc thermal element in close proximity to the aluminum or tin plated brass sensor cap to provide rapid response to temperature changes. Rated for 100,000 cycles up to a maximum operating temperature of 176 F. Actual electrical ratings vary according to operating conditions and other factors. Typical ranges are −20 to 79 F and 80 to 176 F; accuracy within ±6 and ±5 F, respectively, on open and close. Information sent on request. — *Stevens Manufacturing Co., Inc., P.O. Box 1007, Mansfield, Ohio.*

Corrosion Resistant Product For Chimney Interiors

Corrosion resistant product for the interior of brick, steel, and concrete chimneys protects against acids formed by sulfur dioxide and trioxide, and hydrogen chloride and fluoride. Information sent on request. — *Benjamin Foster Co., 4635 W. Girard Ave., Philadelphia 31, Pa.*

Vise Holds Thin-Wall Tubing Without Distorting

Precision machine vise has multiform profiles ground into its hardened tool-steel jaws to grip a variety of shaped materials. Jaws can be positioned to hold rounds, squares, flats, rectangles, angles, tees, or tubing. Main body machined from solid alloy-steel plate and is heat-treated. Literature sent on request. — *C. H. Stoelting Co., 424 N. Homan Ave., Chicago 24, Ill.*

Kansas City, Mo. Airport...

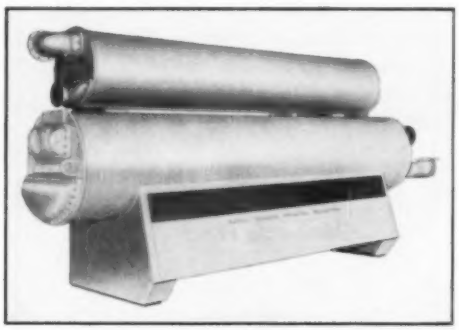
Gets low cost cooling with GAS & CARRIER absorption refrigeration

When the planners of the new Kansas City Airport evaluated air conditioning costs, one system came in lowest on first costs and lowest by a wide margin on operating costs. This system, now in operation, is *gas*-operated Carrier absorption refrigeration.

Energy source for the Carrier absorption system is low pressure steam from a gas boiler. Refrigeration unit uses this steam to provide chilled water for cooling air. Operation is quiet, frictionless. Operating costs stay low with the unbeatable fuel economy of gas.

New high in efficiency at partial loads. Carrier has solved the problem of sustained efficiency at partial loads in absorption cooling. A unique and exclusive Carrier solution-capacity-control gives partial load efficiency unsurpassed by any other type of system.

Keep your air conditioning costs low, and efficiency high, with gas-operated Carrier absorption refrigeration. For full details, call your local Gas Company, or write Carrier Air Conditioning Co., Syracuse 1, N.Y.
American Gas Association



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Architects and Engineers: Cooper, Robison, Carlson & O'Brien. Mechanical Contractor: A. D. Jacobson Plumbing & Heating Company. General Contractor: Interstate Construction Corporation.

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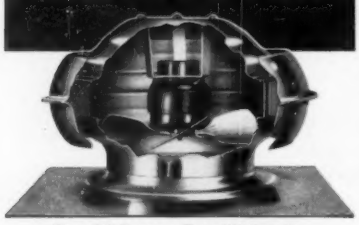
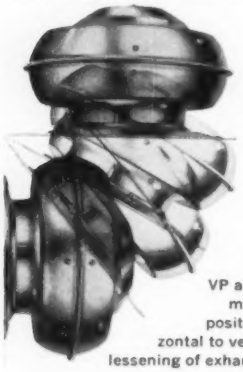
Exit-Aire EXHAUSTER



Type VP Power • Type VA Gravity

These new, modern-design ExitAire units are extra low to conform perfectly with today's architectural requirements . . . extra compact, yet highly efficient. Exceptionally versatile, too—may be used in any position on any flat or pitched roof, on ridge or wall installations (see photo below) . . . and as gravity or power exhaust heads.

Made of heavy-gauge, rust-proof aluminum for long life . . . sturdily constructed. Weatherproof. Available in sizes 8" to 24". Comes with flat base but is also available with flanges turned down and welded for curb mounting (slight additional cost).



Both Types VP and VA may be mounted in any position from horizontal to vertical without lessening of exhaust efficiency.

Catalog of complete ExitAire line of power and gravity exhausters free upon request. Use coupon below.

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EQUIPMENT DEVELOPMENTS

Continued

Pressure Switches for 0.125 To 16 Psi Differential Range

Pressure and differential pressure switches cover 0.125 to 16 psi differential actuation range. Withstands system pressures or overpressures up to 250 psi with no damage or leakage. Within actuation range of a given switch, actuation pressure may be altered by turning a direct reading dial. Switch is either completely actuated or completely disconnected at all times. Standard models have aluminum housings; other materials available. — *Pall Corp., 30 Sea Cliff Ave., Glen Cove, N.Y.*

Core Bits Drill Holes to 3½ In. Diameter in Masonry

Carbide-tipped, hollow-core bits for drilling holes up to 3½ in. in diameter even when masonry is reinforced with steel rods or wire mesh. Water cooling is not necessary. Seven bit sizes are available, from 1⅛ to 3½ in. Units made as a single piece. — *Skil Corp., 5033 Elston Ave., Chicago 30, Ill.*

Relative Humidity Recorder Available in Four Models

Direct-reading instrument available in four models, providing for such features as hand portability or wall mounting, and recording of dry-bulb temperature on the same chart with relative humidity. Uses standard chart drives and pen-arm movements. Measurement limits for relative humidity are from 0 to 100 percent; temperature from 0 to 100 F. Operates on a 24 hr cycle. Weighs 25 lb. Bulletin 98410 sent on request. — *Taylor Instrument Cos., 95 Ames St., Rochester, N.Y.*

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Lasting Accuracy
Dependability
Low Maintenance
Long, Long Service

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Accurate to within 1% from zero to rated capacity regardless of system pressure.

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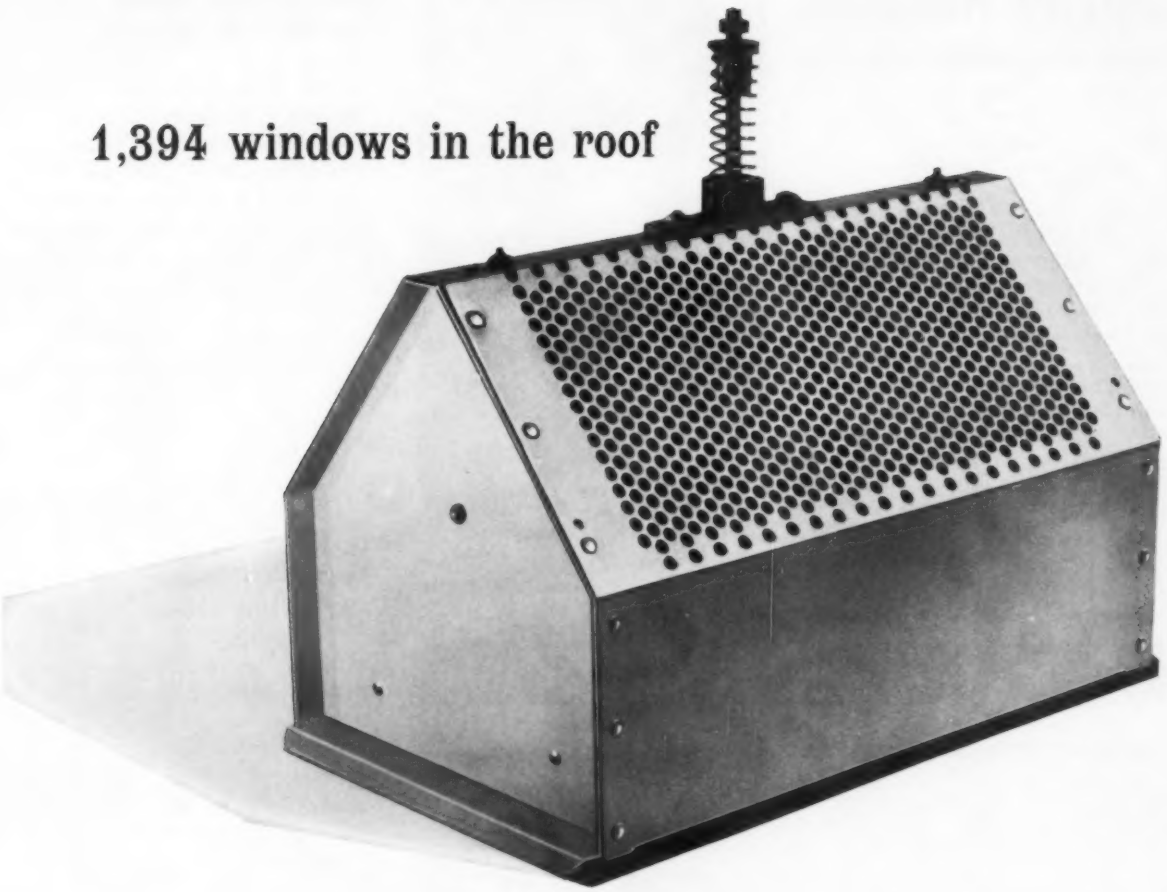
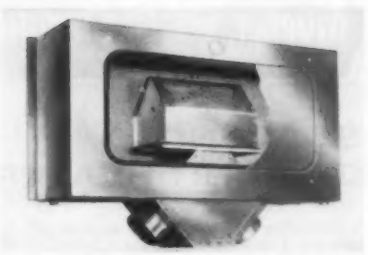
1,394 windows in the roof



This is the "doghouse" in every Dual Duct air mixing unit. Quietly and efficiently, its 1,394 window-like apertures are opened and closed automatically to maintain constant air volume regardless of static pressure variance. That means there's never a balancing problem, never a drop-off or sudden air blast resulting from activity or shut-down in other zones.

For new structure or modernization, Buensod Dual-Duct is the perfect year-'round air conditioning system . . . completely compatible with existing radiation, too.



Buensod-Stacey Type V, Under-Window Dual Duct air mixing unit.

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any capacity
(.15 to 230 gallons per minute!)

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Free: Send for your illustrated copy of Bulletin No. 5900 which describes the broad range of Binks Nozzles available for use in your particular application.

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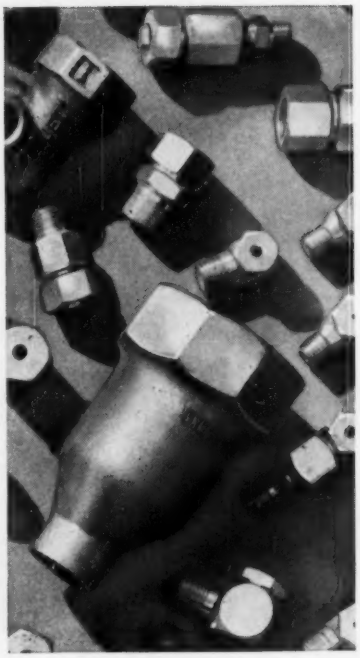

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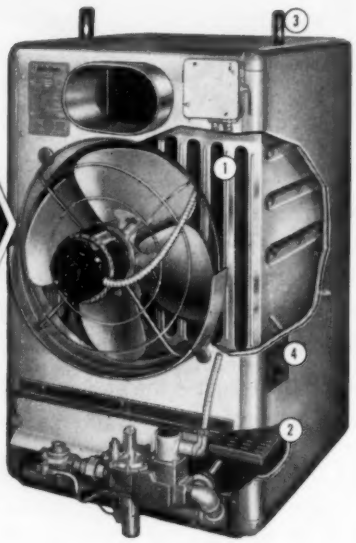

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2. Cast-iron drilled-port burners for "clean", service-free operation.
3. Convenient triple-duty lifting and hanging brackets.
4. Automatic fan and limit control plus summer switch.

Complete size range from 25,000 to 225,000 BTU output. AGA and CGA approved for all gases. Shipped assembled, pre-wired, and test-fired.

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EQUIPMENT DEVELOPMENTS
Continued

Fan and Limit Control For Warm Air Furnaces

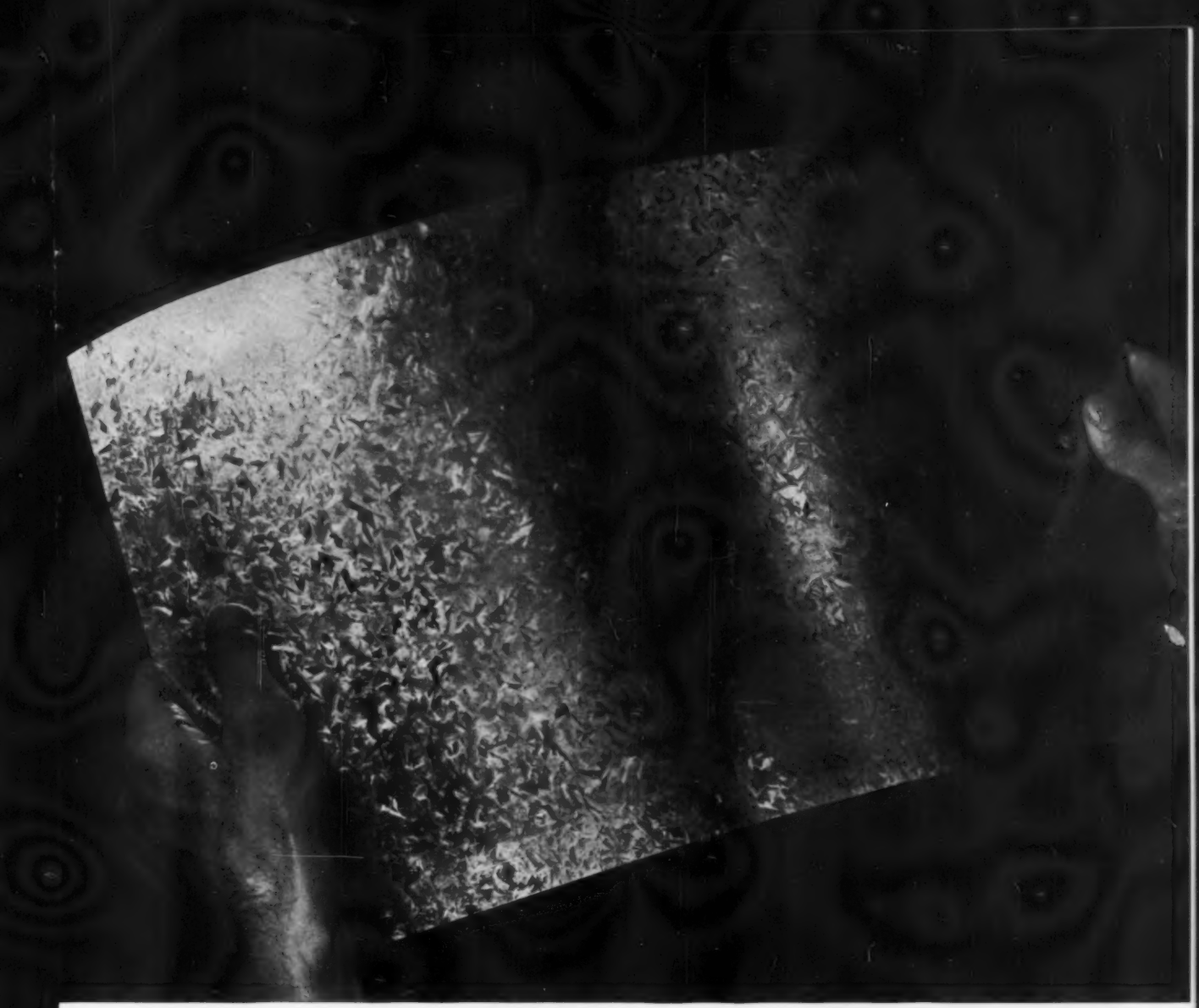
Unit with single element "Klikswitches" available in insertion lengths of 1½, 5, 8, and 11 in. Limit settings fixed at 175, 200, and 250 F, with standard adjustable fan settings on all models. Settings locked into place by a knurled locknut. All internal parts protected from heat by insulating air passages. Information sent on request. — *General Controls Co., 801 Allen Ave., Glendale 1, Calif.*

Thermostats Operate on Line or Low Voltage

Totally enclosed, snap-action unit available in six standard sizes with built-in sub-base features. Can be mounted without adapter plate on a standard 2 × 3 in. switchbox. Bimetal element not affected by vibration. Has dial adjustment; needs no leveling or calibration when installing. Measures 3⅜ × 4½ × 2 1/16 in. — *American-Standard Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.*

Rigid Tube Coupling for High Temperatures, Pressures

Unit maintains its seal under conditions of vibration, shock, pressure overloads, pulsing action, or temperature variations. Provides absolute sealing for all liquids and gases up to 700 F, and 1000 F for certain applications. Remains leak-proof under cryogenic conditions. Testing to date indicates seal is capable of handling 5000 psi helium. Available in sizes from 3 to 24 in. — *Resistoflex Corp., Roseland, N.J.*



Bethcon Galvanized Steel Sheets

have ideal ductility and stiffness for ductwork

Make your own test. Get a piece of Bethcon and flex it back and forth a few times. Notice the snap and life? That means easy forming, and a strong and rigid end product.

Special Annealing Does It

There's a sound metallurgical reason for Bethcon's "extra something." A special annealing cycle in Bethlehem's continuous galvanizing lines gives Bethcon its very desirable characteristics. And the zinc is deposited on the sheet so tightly that even the toughest forming and bending will not crack the coating.

Send for Sample Sheets

You can specify Bethcon in a wide variety of gages and widths, coiled or in cut lengths. The base metal can be either plain open-hearth steel or copper-bearing (Beth-Cu-Loy). A Bethlehem representative will be glad to supply samples and detailed information. Or write us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
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Galvanized Steel

for Strength
. . . Economy
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BETHLEHEM STEEL

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competitively priced!

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Aeromaster
INDUSTRIAL COOLING

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featuring
"QUICK-SWITCH"
BLADES

Blades can
be installed
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on drive shaft

Performance, construction, and price make this the "best buy" in industrial fans! Delivers more CFM with *less* H.P. Features a ductile iron hub, removable blade retention caps, heat treated aluminum alloy blades with constant chord width and flanged ends. 4, 6 and 8 bladed fans available in 54" to 120" diameters. Maximum tip speed is 15,000 ft./min. Easy to install . . . easy to maintain. For complete details, write: KOPPERS COMPANY, INC., 4606 Scott Street, Baltimore 3, Md.

KOPPERS Aeromaster Fans

Engineered Products Sold with Service

you'll want to know

Continued from page 52

compressor is a part of this system.

A 2 hp air cooled condenser, an extended-surface fin and tube type, is mounted on the roof. For winter control, the unit is provided with an automatic device that maintains constant head pressure in the refrigerant circuit regardless of ambient air temperature at the condenser. The Refrigerant 22 in this system cools the Refrigerant 13 in a cascade condenser, circulates through the Refrigerant 22 condenser, and then returns to the refrigerant compressor.

A cascade condenser was used because a low compressor horsepower is required to obtain the desired refrigeration effect. The system, in addition to its maximum cooling capacity per hp, achieves a very rapid temperature pull-down.

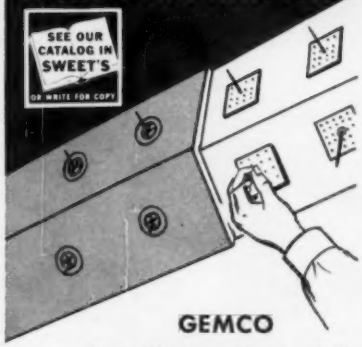
Automatic controls operate the entire system. Low temperature within the room is regulated by a thermostat and electric solenoid valves in the refrigerant supply lines to the evaporators. Compressors for each system operate on suction pressure switches functioning in such a manner as to cut in and cut out compressors as the suction pressure rises or falls below predetermined levels.

Design of equipment to attain a temperature of 200 F in the chamber is presently in process. The system will use a fin-tube convector system suspended from the ceiling. Steam from a central plant will be generated at 150 psi, reduced to 40 psi, and finally to 10 psi for use in the convectors. Control will be attained by using a liquid filled free-vane electronic temperature controller.

The availability of the extreme temperature chamber to the U.S. Army Ordnance Arsenal at Water-

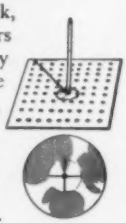
Continued on page 206

SAVE TIME—
SAVE MONEY
with these dependable
INSULATION HANGERS

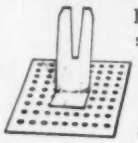


GEMCO
Spindle Hangers and
W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed... with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



GEMCO Pronged Hangers



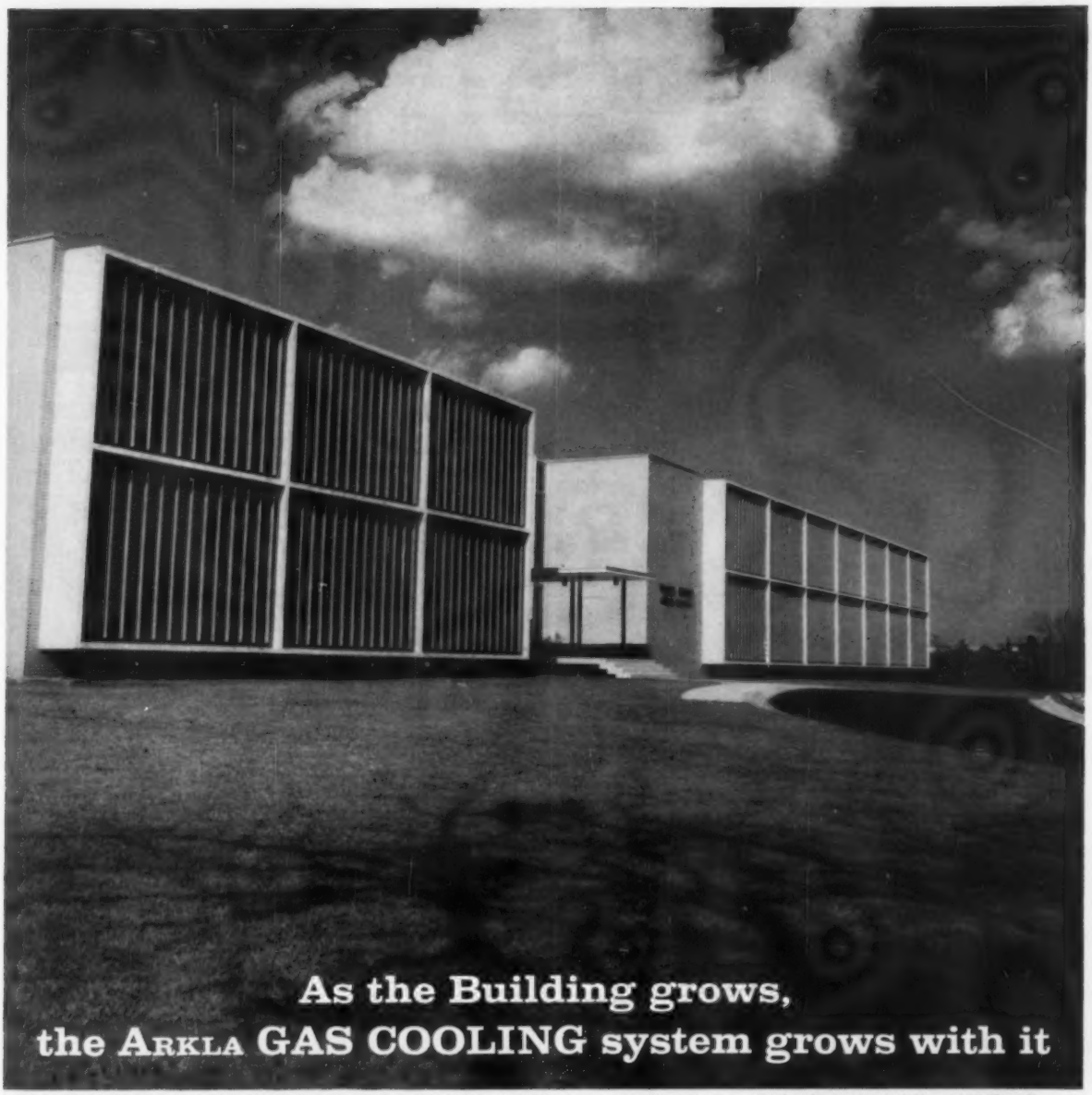
Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6 7/8") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers... with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS



As the Building grows, the ARKLA GAS COOLING system grows with it

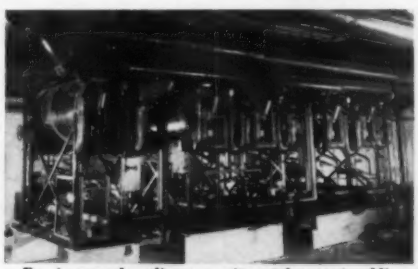
Architect: Folger & Pearson; Mechanical Contractors: Troug & Nichols. Modern gas cools and heats this headquarters building of Yellow Transit Freight Lines in Kansas City, Missouri. The Arkla Gas air conditioning unit uses the same gas-fired boiler that heats in winter to cool in summer.

The headquarters building of Yellow Transit Freight Lines, Kansas City, Missouri, was designed to take a third story without major alterations. That's why they chose Arkla gas cooling units . . . a system that can "grow" quickly and at low cost.

When the building expands, they'll just add an Arkla unit. They go on the line right next to the rest, using the same basic piping – and steam from the same gas-fired boiler that energizes all the Arkla units.

The present cooling system includes five 25-ton Arkla Gas Absorption Water Chillers. These versatile units use steam from the gas-fired boiler to provide chilled water for comfort cooling. The same boiler heats in winter. And thrifty gas keeps fuel costs low.

For specific information on Arkla gas air conditioning, call your local Gas Company. Or write Arkla Air Conditioning Corporation, General Sales Office, 812 Main St., Little Rock, Arkansas.
American Gas Association.

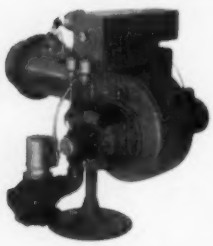


For increased cooling capacity, at low cost, additional Arkla units can be installed.

FOR HEATING & COOLING... GAS IS GOOD BUSINESS!

All New
Webster
DUAL FUEL
CYCLONETIC*
Burner

Superior



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MR
a division of
Midland-Ross Corporation

you'll want to know

Continued from page 204

vliet is a great asset for the defense of the nation. Weapons can be developed and quickly taken to the test chamber. If modifications are found to be needed, these can be done and the gun quickly tested again under the worst of conditions. The hours saved and the capabilities available are prime requisites to today's rapidly advancing technology.

What Not To Do In Small Businesses: Ten Steps to Failure

RALPH BEDWELL, director of Southern Illinois University's Small Business Institute, offers this 10-point checklist which he says covers the "completely unsuccessful small businessman."

1. He never plans for the future and spends most of his time trying to deal with day-to-day problems and crises.
2. He has no confidence in other persons, whether they're partners or consultants.
3. He refuses to delegate any authority to subordinates.
4. He tries to handle too many jobs — all, that is, but the job of management.
5. He doesn't grow "managerially" as his business expands.
6. He won't recognize potential business leadership and help in the ranks of his own employees, even if he has a training program.
7. He is addicted to the myth that more money can solve everything.
8. He doesn't plan his daily business activities, hence he wastes valuable management time.
9. In general, he ignores or is unaware of help, advice, and counsel available to him from uni-

Continued on page 208

SC CLAIR COAT

A Superior
LAGGING ADHESIVE

Created By St. Clair Rubber Co. for the toughest pipe and duct Lagging applications.

NOTE THESE 10 HIGH SCORING POINTS

FAST SETTING - Sets almost immediately for faster application.

LOW FREEZING POINT - Usable after being frozen solid.

NONFLAMMABLE — With fire retardant dried film.

STRONGEST PERMANENT BOND - Proved by comparative tests.

ONE COAT NEEDED - For sleek, semi-gloss finish.

STEAMPROOF - WATERPROOF
By contractors's tests.

NON TOXIC - VERMIN PROOF
Will not settle in container.

FINE APPEARANCE - EASILY WASHABLE - Provides long lasting protection.

Also New
St. Clair LAP SEALING
ADHESIVE #45007

Featuring

FASTEST APPLICATION - No waiting for open time.

ONLY ONE COAT NEEDED

IMMEDIATE TACK - FAST GRAB with STRONG BOND.

FINE BRUSHING CONSISTENCY

WHITE COLOR - No. 45007

TAN COLOR - No. 4570

PERM RATING of .05

NO LAP FAILURES
Laboratory controlled quality.

REPLACES STAPLING - BANDING

HEAT RESISTANT to 300° F.

HIGH STORAGE STABILITY
Several container sizes available.

Write for literature - prices - samples, of either or both adhesives

ST. CLAIR RUBBER CO.
Empire Bldg.
107 Clifford St. Detroit 26, Mich.

Another Advantage of DeZurik Valves:

NO DAMAGE TO BUILDINGS FROM HIDDEN LEAKAGE

YOU KNOW IT WELL . . . . So many air-conditioning valves are "hidden" valves throughout the structure . . . every one of them a potential source of substantial damage if the valve develops leaks. You're safe from those disastrous soaking leaks when you install DeZURIK ECCENTRIC-ACTION VALVES. There's no stem leakage and no seat leakage. Both the stem-packing and the resilient-faced plug are literally self-adjusting to maintain absolute drip-tight dependability in locations where you rarely see the valve. When you wish, you can replace the stem-packing quickly, easily, with the valve remaining on the line. That's just one of the superior features of DeZurik Valves; here are more of them:

Positive leak-free shut-off

. . . On any flow from air to solid

Easy, smooth operation

. . . Regardless of Cycle-Frequency

No lubrication or fuss

. . . Virtually no maintenance needed

No stem freeze-up or bind

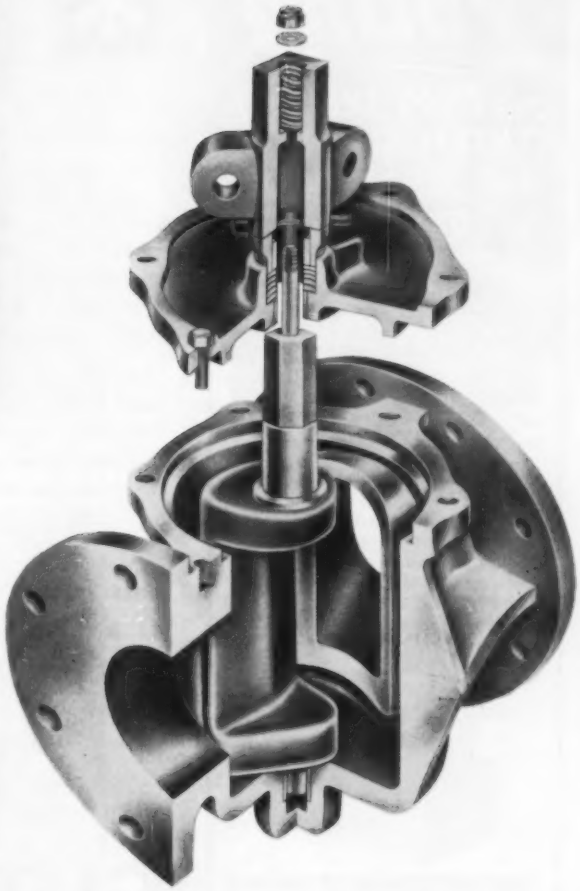
. . . Plus Replaceable Stem Packing

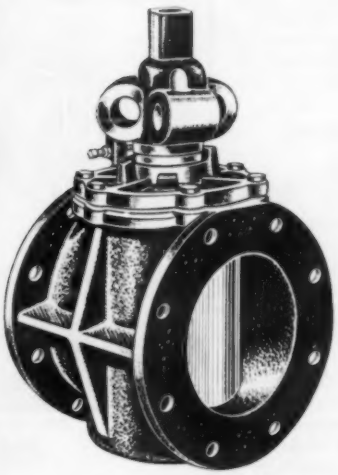
Resistance to corrosion

. . . Full range non-corrosive materials

Exceptional long life

. . . Prolonged performance in toughest use





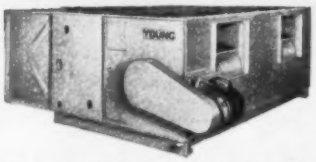
DeZURIK VALVES are produced in a full range of metals and resilient plug facings, in sizes from ½" thru 24". Also available for high-temperature services with special stem-packing and metal-to-metal seating. CATALOG ON REQUEST

DeZURIK CORPORATION
SARTELL, MINNESOTA

Young

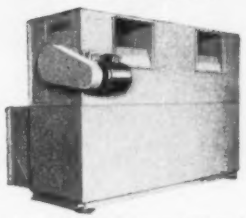
BUILDS THE BEST CENTRAL STATION AIR CONDITIONING EQUIPMENT

HORIZONTAL UNITS



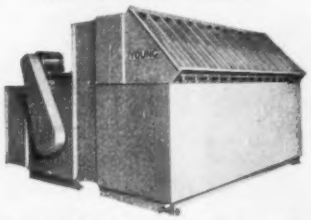
Young CS Horizontal Air Conditioning Units are the solution where "tailor-made" units are needed to meet exacting requirements. Interchangeable sectional design in 10 sizes with capacities from 700 cfm to 28,000 cfm.

VERTICAL UNITS



Sectionally designed Vertical Units are available in the same wide range of sizes and capacities. All types can be assembled in any combination from simple ventilation to complete air conditioning.

MULTIZONE UNITS



Young Multizone Units provide individual area control of air conditioning from a single unit. Nine sizes and a selection of 2 to 21 zones. Ample access panels permit easy servicing.

Write for Catalog No. 7558A

Dept. F-511

YOUNG RADIATOR COMPANY

RACINE, WISCONSIN

Plants at Racine, Wis. and Mattoon, Ill.

you'll want to know

Continued from page 206

versities, trade associations, and other sources.

10. He doesn't keep up-to-date records of any kind—that is, stock control, sales records, or monthly statements. Only at income tax time will he know whether he's made money or not.

Specifically, says Mr. Bedwell, small businessmen should spend less time bewailing competition and more time adopting big-business management procedures.

Lists 7-Point Program To Aid Public, Engineers In Switch to Metric System

FOR MANY years scientists and engineers have been discussing the pros and cons of changing the United States from an Anglo-American to a Metric system of units. Now, Carl F. Kayan, professor of mechanical engineering at Columbia University has proposed a seven-point program to aid the public, scientists, and engineers if the change is made.

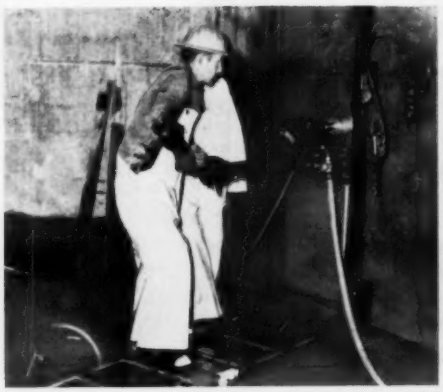
Reported in the Columbia Research News, the plan calls for the following:

Consumer Public

1. Revise elementary school arithmetic programs, deemphasizing common fractions. Stress decimal values instead.
2. Extend decimalization practice for the existing pound, inch, and foot, with elimination of the mixed-unit measurements of weight and length.
3. Streamline present tables of weights and measures and drop units rarely used.
4. Expand use of metric terms

Continued on page 208

CUTTING POWER!



400 holes through 24-inch walls of concrete and heavy steel!

Longyear

To do a real tough job, a heavy construction firm with plenty of diamond drilling experience picked Longyear air-powered drills and 4-inch diamond bits. The rugged feed system and the powerful air motors helped finish the job on schedule. For more information on Longyear air driven and electric drills, write department 5C.

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How to take your dream trip for 63¢ a day

Saving the easy way. The Payroll Savings Plan for U. S. Savings Bonds makes you an automatic saver. The day you join, you begin building your bundle of Bonds—with money you don't see, can't spend and probably won't miss.

You can hardly buy a new tie for a vacation wardrobe with 63¢. But thousands of people pay for a whole trip by putting something into U. S. Savings Bonds every pay day. Just 63¢ a day adds up to $18.75 a month, enough to buy a $25 Savings Bond. In 40 months you'll own Bonds worth $1000 at maturity. And you'll have saved for that dream trip with pocket change you might have dribbled away. Why not start saving for your first vacation Bond today?

Peace costs money. Every Savings Bond you buy helps keep our country strong for Peace . . . so that you and your loved ones can enjoy traveling—and all the things you're saving for.

Money with your name on it. Savings Bonds can be turned into cash anytime. Yet you can't lose your money. Your Bonds are registered in your name and are replaced free if lost or stolen.

WHY U. S. SAVINGS BONDS ARE SUCH A GOOD WAY TO SAVE

You can save automatically on the Payroll Savings Plan, or buy Bonds at any bank • You now earn 3¾% to maturity, ½% more than ever before • You invest without risk under a U. S. Government guarantee • Your Bonds are replaced free if lost or stolen • You can get your money with interest anytime you want it • You save more than money—you buy shares in a stronger America.

You save more than money with U.S. Savings Bonds

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D-H'S POPULAR SPOTAIRE LRC'S SOON
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DIVISION OF
HI-PRESS AIR CONDITIONING OF AMERICA, INC.
3301 Medford Street, Los Angeles 63, California
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you'll want to know

Continued from Page 208

in the press, on radio, and television to help condition public to a possible change.

Technological Phase

5. Extend use of energy-rate of watt into non-electrical fields, i.e., kilowatt rather than horsepower.

6. Revise subject matter of engineering-mechanics, with emphasis on the use of the absolute-system philosophy, using "mass" as the basic unit and "force" as a derived unit, as found in the CGS and MKSA metric systems.

7. Extend the "dimensionless" presentation of experimental data, in conjunction with basic reference values to facilitate operations in any system of units, as exemplified by "specific-heat" and "specific-gravity."

Research Project To Examine Effects of Air Pollution on Laboratory Animals

NEW INFORMATION on the health effects of air pollution are expected as a result of a major research project now underway in Los Angeles, according to the Public Health Service.

The study is a joint project with the Los Angeles County Air Pollution Control District and the University of Southern California to observe the effects on laboratory animals—mice, guinea pigs, and rabbits—of breathing the same air breathed by people in Los Angeles County.

The contaminants of primary interest are those specifically associated with automobile exhaust—hydrocarbons, oxidant, carbon monoxide, oxides of nitrogen, and certain particulates.

While the test animals breathe the air at special sites located at varying distances from the heavily traveled throughways, a control group of similar animals will be living in purified air in a laboratory.

The study represents one of the largest research efforts of its kind yet undertaken in the field of air pollution.

Commenting on the agreement, Dr. L. Otis Emik, Division of Air Pollution, Public Health Service, stated: "In this field of study we have long needed careful observations of the effects on laboratory animals of precisely the same exhaust contaminated air

Continued on page 212

DON'T COMPARE

insul-fil®

WITH ANY OTHER FILL-TYPE INSULATION!

insul-fil Is A Reinforced Hydrocarbon Fill

There's a big difference — a tremendous difference between Insul-fil and all other fill-type insulations for underground piping. Only Insul-fil has the exclusive patented perlite filler that eliminates flow. Insul-fil installations have proven themselves by standing up under all kinds of conditions where other fill-type insulations have failed.

It is a well-known fact that bitumens will flow when subjected to heat or pressure. Even hard bitumens which do not flow will crack when cool.

But Insul-fil, with its perlite filler, is completely different and infinitely more efficient in thermal stability and insulation value. It provides greater structural stability even when used at maximum temperatures.

Perlite Aggregate In INSUL-FIL Makes All The Difference

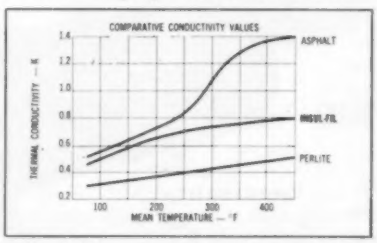
A unique combination of high softening point petroleum asphalt blended with coated inorganic perlite, Insul-fil provides far greater insulation value than any unfilled asphalt. Perlite, made from a volcanic rock which has been crushed, screened and expanded at a very high temperature, is composed of glass-like beads or perls. Each perl contains a maze of "sealed" dead air cells which give Insul-fil its light density and high insulation value. The patented process, developed for waterproofing the perlite, makes Insul-fil far superior in water resistance. In addition, another exclusive Insul-fil development is priming of pipe with Primer #7591, which provides continuous adhesion of Insul-fil to pipe, speeds consolidation, and gives positive protection against corrosion by galvanic action.

INSUL-FIL Most Effective Of All Fill-Type Insulations For Underground Piping

Field installations and all types of conclusive testing prove Insul-fil by far more effective in insulation value.

After Insul-fil is installed and heat is introduced into the lines, the Insul-fil is formed into a homogeneous consolidated mass consisting of a small plastic area of varying thickness at the pipe wall, an accompanying sintered area, and in the lower temperature range an area of unsintered material immediately adjacent to the soil.

Unlike the 100% asphalts, Insul-fil does not crack and craze from thermal shock when the heat is turned on or off and therefore does not provide access for water to the pipe. It is during the critical shut down period of spring and summer when cold pipe is especially subject to corrosion that Insul-fil is so highly water resistant.



Yes! There's a big difference between Insul-fil and all other fill-type insulations for underground piping.

INSUL-FIL Most Economical Of All Fill-Type Insulations For Underground Piping

1 — Comparative cost analysis between Insul-fil and other types of underground conduit proves Insul-fil in place costs substantially less.

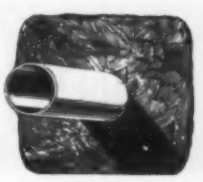
2 — Insul-fil weighs 30% less than other materials, and therefore costs less to ship, less to handle, less to install.

3 — Insul-fil is simple to install. The material is all in one package — 2 cubic feet weighing approx. 57 lbs. Insul-fil Primer supplied free of cost is applied to the surface of the pipe. The loose Insul-fil is poured from the bag around the piping to be insulated, well prodded and tamped, then the trench is backfilled. As simple as that. Heat introduced into the system forms the conduit. Thus labor for installing Insul-fil requires no special skill. The application is a simple, one trade operation.

Insul-fil keeps on saving you money, with its effective control of heat loss and pipe corrosion, eliminating maintenance. Field changes in the installation of Insul-fil underground systems can be made easily, without changes in the material or its application.

Yes! There's a big difference between Insul-fil and all other fill-type insulations for underground piping.

FREE: 40-page Technical Data Book, complete with engineering drawings, heat loss curves, and installation specifications.



insul-fil COMPANY, INC.
DIVISION OF: MIRACLE ADHESIVES CORPORATION
250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N.Y.

you'll want to know

Continued from page 210

which people breathe. These observations may give us the opportunity to observe in animals, during short periods of time, effects which in human beings might take decades to occur."

S. Smith Griswold, Director, Los Angeles County Air Pollution Control District will direct the establishment of four stations at which pollutants will be monitored and animals studied. The initial contract, at a cost of $152,000, will cover the establishment, operation, and maintenance of these stations until June 15, 1961.

The University of Southern California will furnish and operate facilities for housing the exposed and control animal colonies, on the grounds of the University Medical School and at sites provided by the Los Angeles County Air Pollution Control District.

The work at the University of Southern California will be under the general direction of Dr. Leslie A. Chambers, Director of the Allen Hancock Foundation. Members of the faculty of the Medical School who will participate include: Dr. Paul Kotin, Assistant Professor of Pathology; Dr. Oscar J. Balchum, Assistant Professor of Medicine; Dr. John Mehl, Chairman of the Department of Biochemistry.

Contractor Group Seeks Cure For "Non-Productive Hours"

LATE STARTS, early quitting, coffee breaks, and extended lunch periods are adding more to construction costs than is generally realized, according to the Coordinating Committee of the Mechanical Specialty Contractors Associations of Chicago. To combat these "non-productive hours," the association has issued a letter to its members asking them to eliminate these practices.

Specifically, the letter endorses the "Ten Point" national statement of policy adopted by the Building and Construction Trades Department, AFL-CIO, in regard to worker responsibility. Included in these "Ten Points" were these two:

"Workmen shall be at their regular place of work at the starting time and shall remain at their place of work until the regular quitting time."

Continued on page 214

Have your water storage heater

Whitlock Type K Storage Heaters, with an outstanding record of performance, are made in a large variety of sizes, for various operating pressures, and in various constructions. Your local Whitlock engineer will be pleased to talk over your requirements and recommend the heater that will serve best. Type K Storage Heaters are made in plain steel, copper-lined steel, Everdur, and Konkrete-lined constructions. The choice depends upon local water conditions, purity of hot water required and, of course, on cost considerations. The Type K is also made in both horizontal and vertical models to best fit the space requirements and piping layout. Call your local Whitlock engineer today or write for Bulletin 40C.

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Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

NEW DEVELOPMENTS FROM DU PONT:

Traveling assistants for burnout jobs

Here's a new, practical, more effective way to handle refrigeration system burnouts. Not just replacement, not just flushing . . . but *complete* pressure cleaning with Du Pont's new cleaning unit. This new unit utilizes Freon-11*, the most effective selective solvent available for oil, sludge and grease. By completely removing contaminants that can cause new burnouts, you can do the job right the first time . . . eliminate costly, time-consuming call-backs.

Mounted on wheels, this handy assistant is the latest Du Pont effort to make your servicing job easier and more effective. And when it's time to recharge the system, you'll find Du Pont's improved lightweight "Zephyr" cylinder makes the job easier. Take a "Zephyr" on your next burnout . . . or any other job. You can't go wrong.

Leading air conditioning and refrigeration wholesalers who sell "Freon" refrigerants can probably rent you one of the new Du Pont units now. But if you'd like to build your own, write to: Du Pont Co., N-2420HA, "Freon" Products Division, Wilmington 98, Delaware. Ask for Bulletin FD-1.

FREON® *premium quality* **REFRIGERANTS**

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

**FREON and F- followed by numerals are Du Pont's registered trademarks for its fluorocarbon refrigerants.*

you'll want to know

Continued from page 212

"So-called area practices, not a part of collective bargaining agreements, should not be recognized nor should they be enforced."

The policy, therefore, is clear, the letter said. So is the matter of enforcement. It is solely up to each employer to see that these abuses do not occur. Unfortunately, however, there is a tendency for employees to "follow the leader" when they see one group leaving early, making it difficult for the employers of other groups to prevent the same thing.

"Eight hours work for eight hours pay" must become more than a mere slogan if we are to continue as contractors and as potential employers, the letter goes on to say.

Plastic Ventilating System Exhausts Acid Fumes from Wire Coating Operations

PARTICULAR CARE had to be taken in providing a ventilating system for the wire coating line at American Steel & Wire Division of U.S. Steel Corp. The system had to be able to withstand the corrosive effects of fumes from the heat treating furnace, muriatic acid pickling line, hot rinse, zinc coating, and final rinse operations that are running 24 hours a day.

The ventilating system covers 150 ft of the coating operation extending from the entrance end of the pickling tanks to the exit end of the plating tanks. Over the various baths is suspended a long, dome shaped plastic hood which narrows directly over the baths to a 3¼ in. slot divided in the center to draw fumes from both sides of the baths. This hood is exhausted by three plastic motor-powered fans which connect directly into the three 80 ft plastic towers, according to the Carl N. Beetle Plastics Corp.

The ventilating system is fabricated in sections from ¼ to ½ in. plastic. They are held to relatively close tolerance.

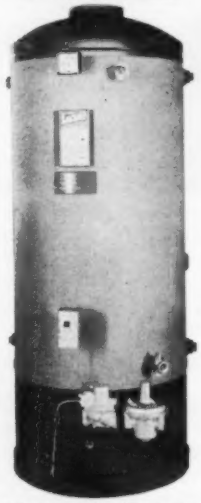
The first section of hood is above three connected muriatic acid tanks. It is vented by a 42 in. fan powered by a 25 hp motor. Fumes are drawn off by its tower at the rate of 30,000 cfm.

The zinc plating line is vented by two 36 in. fans, each powered by a 20 hp motor. Exhaust rates are 20,000 cfm for each tower.

When salt crystals began to form in the system because of the zinc plating operations, a water spray system was installed which permits frequent and internal washing of hoods and towers.

Continued on page 216

Announcing
4 NEW MODELS



USES ANY TYPE GAS

Ewing

FULLY AUTOMATIC GAS-OPERATED
COMPACT VERTICAL TYPE
COMMERCIAL-INDUSTRIAL
WATER HEATERS & BOILERS

A Ewing Heater-Boiler ELIMINATES EXPENSIVE, SPACE-CONSUMING STORAGE TANKS. THE VERTICAL DESIGN ALSO SAVES VALUABLE FLOOR SPACE. Choice of 4 sizes for a multitude of uses.

Perfect for:

APARTMENT BUILDINGS, ATHLETIC PLANTS, BAKERIES, CHURCHES, BATH HOUSES, BARBER AND BEAUTY SHOPS, CLINICS, COUNTRY CLUBS, BAPTISTRIES, QUICK CAR LAUNDRIES, HOSPITALS, HOTELS, MOTELS, FOOD ESTABLISHMENTS, OFFICE BUILDINGS, SUPER MARKETS, LAUNDRIES OF ALL TYPES, CLEANING PLANTS, SERVICE STATIONS, INDUSTRIAL PLANTS AND MACHINE SHOPS, POULTRY PROCESSING PLANTS, ENGRAVING AND PLATING PLANTS, SWIMMING POOLS AND MANY OTHER USES.

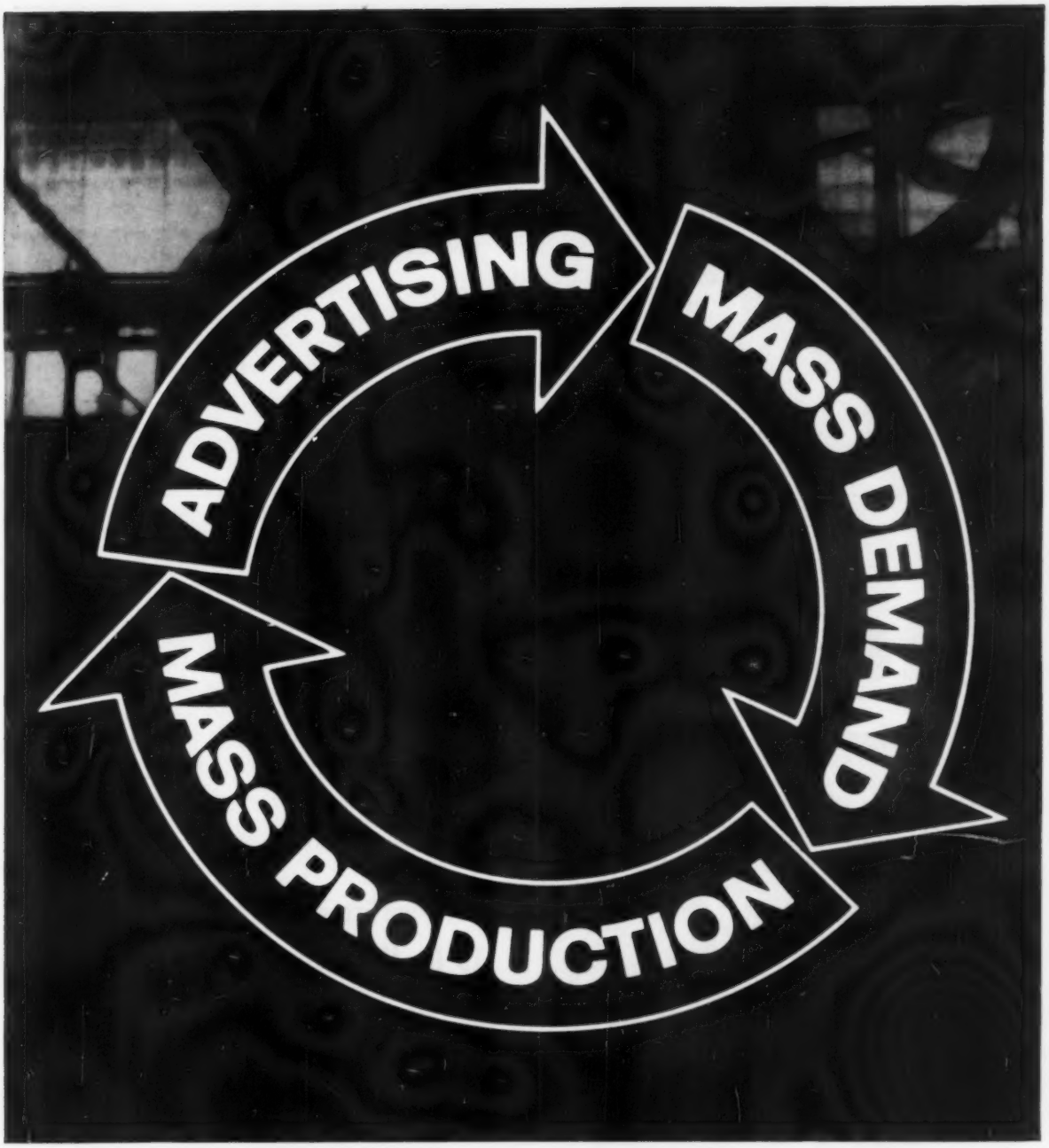
All four models are built to specifications, meeting American Gas Association requirements, and are approved by its testing laboratories. Also tested and inspected in accordance with the rules of ASME Heater and Pressure Vessel Code. Each unit superbly engineered.

Burner assembly complete and factory installed—Gas Pressure Regulator—AGA and ASME Temperature & Pressure Relief Valve—Temperature & Pressure Gauge—Gas Valve—Aquastat—Draft Diverter—Dielectric Unions—Magnesium Rods—All Controls Self-generating.

Thousands in operation from Coast to Coast. Backed by quality construction and experience dating back to 1924. The Ewing name is your guarantee of satisfactory and economical operation. Ewing models are quick and easy to install. Ask a Ewing owner what HE thinks of his Ewing heater-boiler.

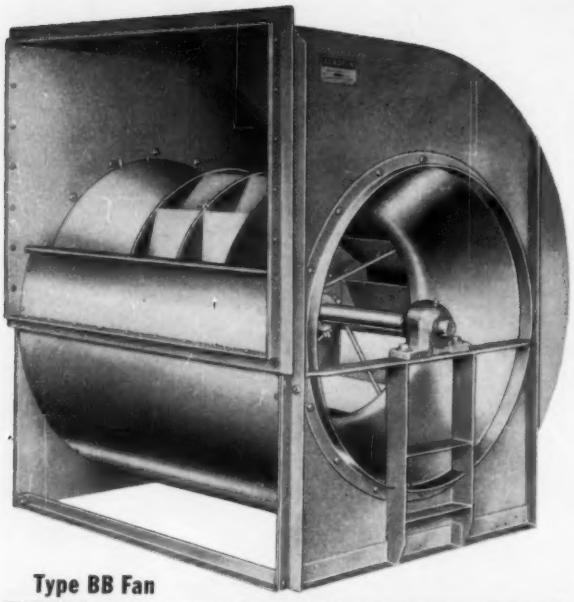
SEND FOR SPECIFICATIONS, PRICES
Complete data sheet, specifications and prices upon request. Recovery capacities 268 to 793 gallons per hour at 100 degrees temp. rise.

Ewing MANUFACTURING CO.
2545 NW 10 P. O. BOX 875
OKLAHOMA CITY, OKLA.



Let's Keep Rolling Ahead

We Americans invented mass production, then we *had* to build mass demand to keep the wheels turning. For this purpose we called upon advertising – the most effective and economical means of creating mass demand. Soon we had more jobs, higher incomes, and better living conditions. And there isn't any limit to how much farther we can go, if we just keep it rolling!

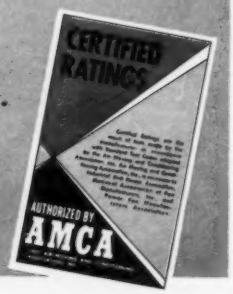


Type BB Fan

Aladdin
AIR HANDLING EQUIPMENT

For
EFFICIENCY and
QUIET OPERATION...

CERTIFIED
PERFORMANCE



ALADDIN Type BB Fans are the first choice of many engineers for heating, ventilating and air conditioning jobs. Designed for low rotational speeds and high efficiency, these fans insure that stable performance from free delivery to shutoff that engineers have come to expect of this type of equipment.

In designing the BB Fan, Aladdin engineers have refused to short-cut quality, each fan is ruggedly built and is backed by thirty-five years of experience and manufacturing know-how.

Write for complete data

A1

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

you'll want to know

Continued from page 214

Pre-War Smog Level Possible For Los Angeles County by 1965

LOS ANGELES COUNTY could be as free of smog by 1965 as it was in 1940, according to the conclusion reached by the Air Pollution Control District in a 290 page report submitted recently to the Board of Supervisors by APCD officer S. Smith Griswold.

The prediction that smog may be reduced to its pre-war level by 1965 is based upon these facts, the report states:

1) Many contaminants from non-moving sources already have been reduced below the 1940 level.

2) The other contaminants of significance from non-moving sources should be reduced to that point by developments already under way or planned for the next few years.

3) Effective air pollution controls for motor vehicles are scheduled to be on most vehicles by 1965.

After 1965, however, a continuing effort will be needed to restrain pollution as industry, population, and motor vehicles continue to increase and expand into areas now underdeveloped, the report states.

UA Pipefitter Apprentice Contest To Be Held August 14-18 at Purdue

THE United Association Eighth Annual International Contest for Pipe Fitting will be held August 14 through 18 at Purdue University, Lafayette, Indiana.

Procedure for the contest, as set forth in the U.A. "Contest Rules," prepared by the International Joint Pipe Fitting Apprentice Contest Committee, require that each participant in the international contest be a winner of a State or Canadian Province contest. Only one such contestant from each of the above areas will compete. Contestants in the state and provincial contests are winners of local competitions, sponsored by the Joint Apprenticeship Committee or local union officers.

The contest is open only to fifth-year apprentice members of local unions in the United Association. It will consist of both written and performance tests, for which first, second, and third-place awards will be announced at a dinner on August 18, at Purdue University.

RECENT TRADE LITERATURE...

Boiler Air Heaters

Report gives the conclusions and recommendations of a study of boiler air heaters conducted by the U.S. Army Corps of Engineers. Covers such topics as causes of air heater fires, cleaning, blowing soot from tubes, and causes of tube corrosion. — *M. L. Sheldon & Co., Inc., 350 Lexington Ave., New York 16, N.Y.*

Controlled Bolt Loading

Six page bulletin describes single stage units for controlled bolt loading with 9 to 243 lb pull capacities and 1 9/16 to 6¾ in. OD; and two-stage units with 162 to 1412 lb pull capacities. Special sizes also available. Gives basic principles of controlled loading. Illustrated with tables and line drawings. — *Biach Industries, Inc., 10 Indian Spring Rd., Cranford, N.J.*

High Temperature Paint

Bulletin LL-4235 describes "Extra High" aluminum paint that withstands temperatures to 1700 F without blistering or burning. Dries in approximately 30 min forming a metal coating resistant to moisture, corrosion, mild acids, alkalis, and industrial fumes. Can be applied by brush, spray, or dip. — *Chem Industrial Co., 3784 Ridge Rd., Brooklyn 9, Ohio.*

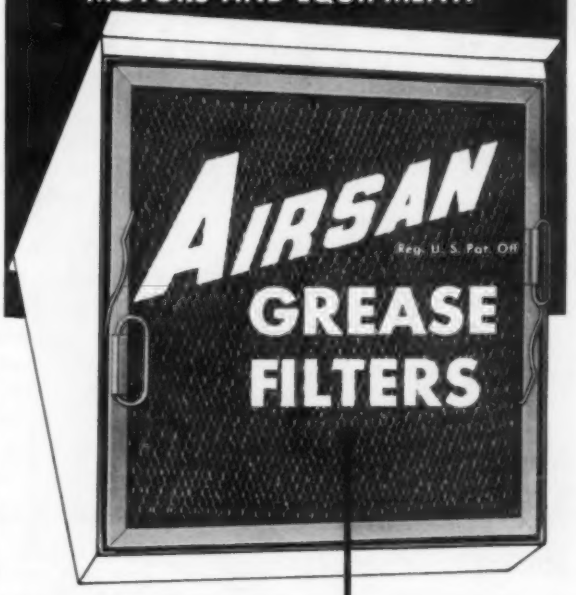
Testing After Motor Burnouts

Twelve page report presents a method for field-testing contamination and cleaning of air conditioning systems after hermetic motor burnouts. Also gives a short cut procedure for cleaning mildly contaminated systems. Procedures are listed in one-two-three order and are fully illustrated. Test determines how much acid is present in the system after burnout and after cleaning. — *Allied Chemical Corp., General Chemical Div., 40 Rector St., New York 6, N.Y.*

Air Pollution Control

Twenty page booklet *Together We Can Check the Blight of Air Pollution* examines the problem and offers ways of controlling it. Several proposals are made in regard to legislation, individual and group action, and government scholarships for training personnel to work in the abatement program. — *John Wood Co., Air Pollution Control Div., Florham Park, N.J.*

Reduce FIRE Hazards
PROLONG THE LIFE OF FANS, MOTORS AND EQUIPMENT!

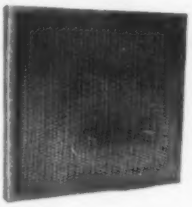


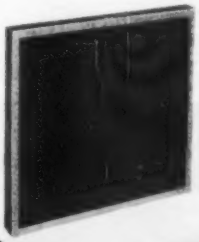
• **PERMANENT, CLEANABLE TYPE AG**
Made especially for range canopies, galleys, kitchens, ventilation systems.
• **EXTRA HEAVY CONSTRUCTION**
Provides better thermal mass to resist "burn-outs." To offer longer service, also available in stainless steel enclosing frames.
• **PRE-ASSEMBLED UNITS for CEILING or WALLS**
Completely pre-assembled units available . . . just set in place and bolt together. Save time and labor costs. Eliminates complex assembly problems. Available in stainless steel, steel, aluminum.

Prevents grease from entering exhaust ducts, protects motors, increases working comfort to provide safe kitchens for Industrial Plants, Hospitals, Hotels, Etc. Write for bulletin G505.

AIRSAN AIR FILTERS...
give you better filtering efficiency because they're engineered to your needs. Write for details.

AIR FILTERS (Low Velocity) Type AF
Viscous impingement type, permanent and cleanable — designed for industrial, commercial and domestic use. Available in 1" and 2" thickness. Bulletin No. 302.





VIRO-CRIMP (High Velocity) Type W
Has a specially designed high velocity Viro-Crimp Filter media. Hemmed edges provide a safety feature. Operates efficiently at 300 to 600 fpm. Available in 2" and 4" thickness. Bulletin No. W-803.

SEND FOR FREE BULLETINS!
Air Filter Corporation
A few distributorships available. Write for details!
4554-P West Woolworth Ave., Milwaukee 18, Wis.

RECENT TRADE LITERATURE

Continued

Radiant Heating, Cooling

Four page external house publication, *The b.t.u.*, provides information, new trends, and technical data on radiant heating, cooling, and acoustic ceilings. Features case histories of installations at schools, hospitals, and office and commercial buildings. Publication is mailed monthly at no charge upon letterhead requests. — *Burgess-Manning Co., Architectural Products Div., 749A E. Park Ave., Libertyville, Ill.*

Automatic Control Valves

Four page bulletin describes various types of control valves including pneumatic; relief; float; lever; altitude; and cylinder operated units. Also includes: motor operators; valves for motor operation; steam pressure regulators; water and air pressure regulators; vacuum breakers and regulators; and pump governors. Illustrated with photos and line drawings. — *Schade Valve Manufacturing Co., 2527 N. Bodine St., Philadelphia 33, Pa.*

Protective Coatings

Eight page bulletin describes process of applying protective metallic coatings to steel without the use of electric current. Products to be coated are either made by firm or supplied by customer. Coatings can be nickel, copper, cobalt, molybdenum, or other metallic alloys. Gives list of materials and shapes that are applicable to treatment. Illustrated with photos and graphs. — *M. L. Sheldon & Co., Inc., 350 Lexington Ave., New York 16, N.Y.*

Pneumatic Totalizer

Two page specifications sheet 282-09.201-1 describes self contained pneumatic totalizer. Operates on either square root or linear signals. Requires only air input signal and electrical power connections. May be serviced without removal from the panel. Optional mercury switch makes unit a transmitter for operation of secondary equipment or for start-stop pacing of chemical feeders. Illustrated with dimensional drawing with panel cut-out. — *B-I-F Industries, P.O. Box 276, Providence 1, R.I.*

Pressure Regulator

Two page bulletin describes unit for uncontaminated sampling of compressed gases. Single-stage stainless steel unit for use where gases with minute impurities are analyzed, such as in trace oxygen, total purity, or chromotography measurement. Gives application data along with specification. Illustrated with photos, line drawings, and a graph. — *Thermo Instrument Corp., U. S. #20, La Porte, Ind.*

Hottest "Spot" in the Shop

the NEW miller LECTRO SPOT

Simply depress lever and tongs grip metal at pre-determined pressure, switch is turned on and weld sequence timer is actuated for precise period set on control dial. Thus, every weld is identical until timer adjustment is changed. Pilot light indicates when welder is connected.

This advanced design plus light weight and wide selection of tongs make the new Miller Lectro Spot the finest welder of its type.

Available in three styles: 115v or 230v, 1.5 KVA models for work to 1/8" thickness, both weigh 29 lbs.; 230v, 2.5 KVA model for mild steel to 5/32", weighs 37 lbs.

Complete specifications with tong and tip availabilities will be sent promptly upon request.

miller ELECTRIC MANUFACTURING COMPANY, INC. • Appleton, Wisconsin

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

RECENT TRADE LITERATURE

Continued

Electrical Machinery

Forty-eight page *Catechism of Electrical Machinery* presents in a simple form the most important theoretical and practical features of the common types of direct-current and alternating-current motors and control equipment. — *Fairbanks, Morse & Co., Electrical Div., Dept. EB, 303 N. Henderson, Freeport, Ill.*

Replacement Motors

Four page bulletin describes units for room air conditioners in the 1/3 through 3 ton range. Includes complete performance data. Illustrated with dimension diagrams, photos, and tables. — *Redmond Co., Inc., Distributors Div., Owosso, Mich.*

Infra-Red Heating

Eight page bulletin CH-100 describes electric units with 550 to 6000 w capacities. Gives principles of heating method, compares radiant heating with other forms of heating, compares electric to gas radiant heating, and lists various applications. Includes electrical specifications, radiation distribution patterns, and dimensions. Illustrated with line drawings, photos, tables, and graphs. — *Fostoria Corp., 1200 N. Main St., Fostoria, Ohio.*

Heating-Ventilating Units

Catalog 58Cla describes multizone heating and ventilating units in 10 sizes from 1000 to 35,000 cfm. Modular design of horizontal and vertical units permits flexibility of motor and coil location. Steam or hot water coils are used. Units available with optional filter boxes, mixing boxes, and preheat coils. Brochure lists nominal rating data, dimensions, arrangements, and specifications. — *Recold Corp., 7250 E. Slauson Ave., Los Angeles 22, Calif.*

Moisture-Liquid Indicators

Two page bulletin 279 describes units for air conditioning systems and other applications. Units incorporate a quick-reacting color-changing moisture-sensitive element and leakproof fused sight glass. Dimensions, line sizes, connection types, relative moisture concentration in system, and other reference data presented in tabular form. — *American-Standard Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.*

NEW! AUTOMATIC SELF CLEANING

LINT-A-MAZE ARRESTOR

Cleans the air of...

* LINT
* CHAFF
* FIBROUS MATERIAL

AIR-MAZE LINT-A-MAZE FILTERS are specially designed to provide 98% or more efficiency in removing heavy concentrations of lint, chaff, leather cuttings and similar materials from the air. Brushes mounted on a chain carrier continually sweep and automatically clean the collector screens. Collected material is deposited in a hopper for reprocessing or sale. Lint-A-Maze filters offer these important advantages:

- Low initial cost . . . low operating cost
- Require less than 50% of the space normally needed
- Virtually eliminate maintenance – no rolls or blankets to replace, no washing or cleaning
- Handle wet or dry impurities
- Can be installed in any recirculating air opening, ventilating or air-conditioning system
- Available for airflow requirements from 7,000 to 150,000 CFM, can handle air velocities from 250 to 1900 FPM.

AFI MEMBER

FREE! For additional information write for Bulletin No. 150.

AIR-MAZE DIVISION
CLEVELAND 28, OHIO

ROCKWELL-STANDARD CORPORATION

over 30 years experience in
AIR CONDITIONING

usAIRco

PACKAGE-AIRE

7700 Series

Water and Air Cooled

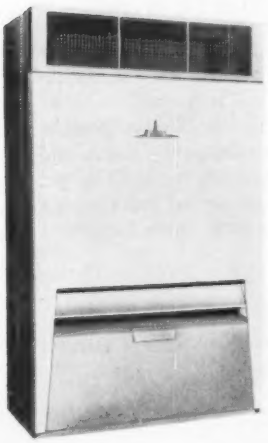
Attractive self-contained units for installation within the air conditioned area. May be used in conjunction with

AIR COOLED CONDENSER

8400 Series

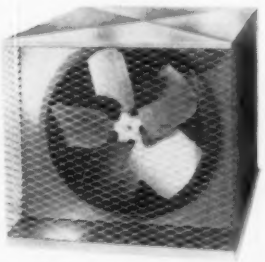
for remote outside or on-the-roof location

to provide an attractive, floor-space-saving air cooled system.



7700 Series
PACKAGE - AIRE
Air Conditioner

8400 Series
AIR COOLED
Condenser



6 sizes with capacities of

36,000 BTU/hr to 240,000 BTU/hr (water-cooled)
33,000 BTU/hr to 214,000 BTU/hr (air-cooled)

Write for Bulletins No. 77 and No. 84

United States Air Conditioning Corporation
Delaware, Ohio

RECENT TRADE LITERATURE

Continued

Ball Valves

Thirty-two page catalog 1200 describes both manually and pneumatically operated ball valves in sizes from ¼ through 12 in. Units with screwed, socket weld, and flanged ends are listed for temperatures from −150 to 600 F, pressures to 1000 psig, and vacuum to 10^{-6} mm Hg. Two basic types of valves cataloged in detail: a top-entry unit which may be opened for inspection or repair without removing the body from the line, and a valve with one-piece bar stock body and end adapters. Illustrated with photos, line drawings, tables, and graphs. — *Hills-McCanna Co., 400 Maple Ave., Carpentersville, Ill.*

Pocket Dynamometer

One page bulletin describes unit for measuring torque and power loading of small electric motors in the field. Accuracy is within ½ of 1 percent. — *Micro Pump Corp., P. O. Box 392, Danville, Calif.*

Electric Motors

Sixteen page bulletin B-2515 describes a-c motors with capacities from 1 to 2000 hp. Also briefly describes fractional hp motors. Units available in open, enclosed, and explosion proof models. Lists features and production control methods. Illustrated with photos and exploded view. — *Reliance Electric and Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.*

Tubing

Four page bulletin 12-10 gives principal characteristics and size range of carbon and alloy steel tubing for mechanical and hydraulic applications. Stainless steel, aluminum, and industrial plastic tubing are also covered. Tips on when to use tubing instead of bar stock included. — *Joseph T. Ryerson & Son, Inc., P.O. Box 8000-A, Chicago 80, Ill.*

Electrical Testing Kit

Two page catalog sheet AAD-1 describes electrical testing kit that serves as a voltmeter, ammeter, and ohmmeter. Unit measures within ∓3 percent accuracy. Lists features, specifications, and operational data. Illustrated with line drawings and tables. — *Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, N.Y.*

RECENT TRADE LITERATURE

Continued

Plastic Pipe Insulation

Four page bulletin describes flexible foamed plastic pipe insulation with a K value of 0.28 at 75 F. Withstands temperatures up to 220 F. Lists temperature limitations; thermal efficiencies; vapor barrier and fire ratings; sizing data; and other information. Illustrated with photos and tables. — *Gustin-Bacon Manufacturing Co., 210 W. 10th St., Kansas City, Mo.*

Valve Flow Characteristics

Twenty page bulletin V-602 explains two methods for determining flow characteristics of firm's valves. Covers the fundamental method of determining pressure drops for all types and sizes of lubricated plug valves, including the Venturi types. Also gives method of estimating pressure drop through Venturi type valves. Illustrated with tables and graphs. — *Rockwell Manufacturing Co., Nordstrom Valve Div., 390 N. Lexington Ave., Pittsburgh 8, Pa.*

Storage Water Heaters

Eight page bulletin 1234 lists storage and heating capacities, dimensions, and material thicknesses for vertical and horizontal water heaters of plain steel, copper silicon, copper lined, and "Pre-Krete" lined. Describes a packaged unit, indirect gas fired, with storage capacities from 250 to 4000 gal and recovery capacities from 390,000 to 2,215,000 Btu per hr. — *The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.*

Gas Venting Materials

Four page bulletin No. 3 entitled *Proper Gas Venting* explains the corrosion resistance of gas venting materials. Covers chemical and electrolytic corrosion only. Illustrated with photos and tables. — *Gas Vent Institute, 333 N. Michigan Ave., Chicago 1, Ill.*

Centrifugal Pumps

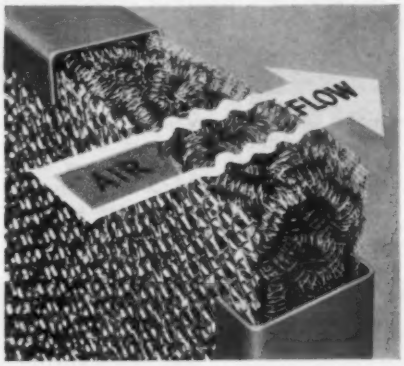
Eight page bulletin 722.4 describes high pressure multi-stage centrifugal pumps with capacities up to 2600 gpm for heads up to 3400 ft. Maximum working pressure is 1200 psi. Gives complete specifications, performance curves, construction materials, and dimensions. Illustrated with photos, line drawings, and tables. — *Goulds Pumps, Inc., 223 Black Brook Rd., Seneca Falls, N. Y.*

VORTOX

AIR FILTERS

DUST AND GREASE

The Coil Springs Tell The Story



SELECTED TERRITORY AVAILABLE FOR QUALIFIED REPRESENTATIVES

AIR FILTER BANK

AFI MEMBER AIR FILTER INSTITUTE

WHY SUPERIOR?

- Large dust holding capacity
- Impingement type
- Low pressure drop
- All metal construction
- Uniformity and proper spacing of filaments
- Efficient filtration at high and low air velocities

Specify VORTOX — Air Filters Engineered and Built for a LifeTIME

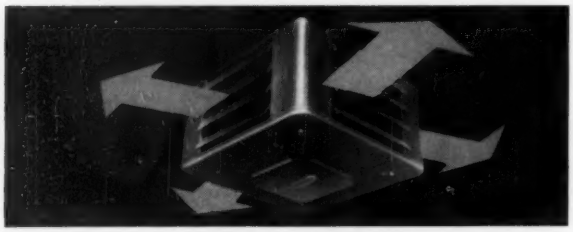
VORTOX COMPANY

CLAREMONT, CALIFORNIA
(LOS ANGELES AREA)

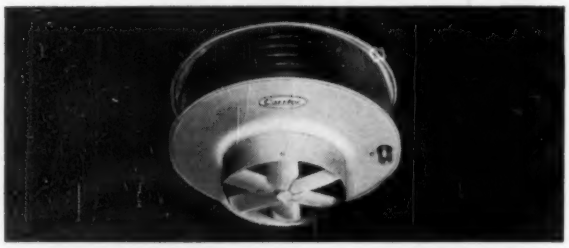
Which is best for your job?

CARRIER UNIT HEATERS

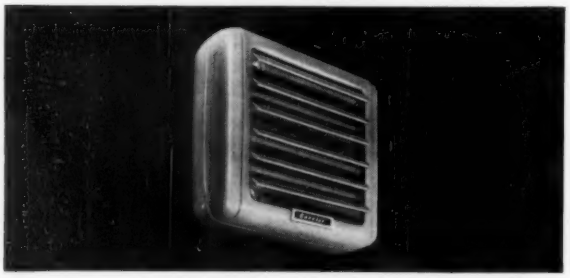
for steam and hot water heating systems!



4-way discharge model (46S) "Clover Leaf" pattern can discharge air in as many as four directions at once. Using all four outlets, the largest Carrier unit can heat a room over 100 feet square. Without changing outlets or adding accessories, these units can be used to heat L, T, I or square-shaped areas. Suspension type, for use with high or low pressure steam or forced hot water. Eight sizes from 55,000 to 600,000 Btuh.



Vertical discharge model (46SE) For economical heating in spaces with high ceilings or where "clear span" areas are required. Uses high or low pressure steam or forced hot water. In 15 sizes from 44,000 to 1,000,000 Btuh with standard or low temperature rise coils. Available in three outlet types: adjustable cone, adjustable radial diffuser and cone anemostat.



Horizontal discharge model (46U) Smart appearance and high efficiency are combined in this propeller fan unit. For high or low pressure steam or forced hot water. Single row coil with deep, smooth fins delivers maximum heat transfer, offers less air resistance, reduces power consumption. In ten sizes from 13,000 to 200,000 Btuh.

For information, call the Carrier representative listed in your Classified Telephone Directory under "Heaters—Unit." Ask for Catalogue 46-106. Other equipment in Carrier's heating line-up includes Heating and Ventilating Units for steam and hot water, and Gas-fired Unit Heaters and Duct Furnaces. Carrier Air Conditioning Company, Syracuse 1, New York.

Carrier ***Air Conditioning Company***

WE HEAR THAT . . .

Fred M. Young, president and founder of *YOUNG RADIATOR CO.*, was cited for outstanding accomplishment in his field at the 13th Annual Wisconsin Engineers' Day celebration May 5. He received a Distinguished Service Citation recommended by the University of Wisconsin College of Engineering faculty and Conrad A. Elvehjem, president.

JOHNS-MANVILLE CORP. will establish new business offices in each of 12 key areas throughout the nation: Atlanta, Boston, Chicago, Cleveland, Denver, Houston, Los Anegeles, New York, Philadelphia, San Francisco, St. Louis, and Seattle.

PENN CONTROLS, INC. has acquired the *PIONEER ELECTRIC & RESEARCH CORP.* through an exchange of stock. The acquired firm will operate as a wholly-owned subsidiary of Penn and will function independently under its present management.

Emil T. Johnson has been elected president of the *NATIONAL INSULATION MANUFACTURERS ASSOCIATION*. M. W. Burleson is the new vice president; Ike Keith, treasurer; and John M. Barnhart, executive secretary.

The *NATIONAL OIL FUEL INSTITUTE* has occupied new offices in the Lincoln Building, 60 E. 42nd St., New York, N.Y.

VIRGINIA CHEMICALS & SMELTING CO. is the new name of the former Virginia Smelting Co. The change was made to "reflect more accurately the nature of our business," according to a company official.

CHEMICATOR, INC. has been formed to manufacture and distribute a device for the automatic treatment of water in cooling towers and evaporative condensers. Main offices will be located at 700 S. Flower St., Burbank, Calif.

The entire manufacturing facilities of *SUN-HEAT, INC.* of Holt, Mich., have been moved to Detroit. The firm's new address is 998 E. Woodbridge.

Ray M. Harmon, Jr., president of *HARMON & BECKETT, INC. & ASSOCIATES*, consulting engineers of Denver, Colo., will accompany the U.S. Department of Commerce's first Trade Mission to eight French-speaking republics in West Africa.

WE HEAR THAT

Continued

HILLS-McCANNA CO. has moved its Chicago executive and general offices to the company's manufacturing plant in Carpentersville, Ill. Chicago area field sales personnel have moved to the company's Foundry Div. in Chicago.

HANDY & HARMAN has moved into new offices at 830 Third Ave., New York, N.Y.

IDEAL CORP. has acquired exclusive manufacturing and sales rights to a plastic pipe clamp introduced by *WIORA PRODUCTS CORP.* The clamp covers all pipe from ½ through 2 in.

BENJAMIN & FLACK, consulting engineers, have opened a branch office in Dayville, N.Y. The address is 17 Main St., P.O. Box 476.

BRYANT MANUFACTURING CO. has established a branch office in New Orleans, La., at 2836 Frenchmen St.

A Switzerland office has been opened in Lausanne by the *CLAYTON MANUFACTURING CO.* The branch is named *CLAYTON S.A.*

DUNHAM-BUSH, INC. has formed a national service organization for its equipment. Regional service managers will be headquartered at the firm's five plants.

The *AMERICAN PETROLEUM INSTITUTE* has selected five organizations to work on the principal projects of a special oil burner research program. The names of the research groups and the projects are: Armour Research Foundation, Chicago: air-fuel mixing and recirculation; Arthur D. Little, Inc., Cambridge, Mass.: new means for fuel atomization; Atlanta Research Corp., Alexandria, Va.: ways to minimize deposits during vaporization of No. 2 heating oil; Battelle Memorial Institute, Columbus, Ohio: more suitable ignition systems, air compressors, and fuel pumps for small oil burners; Stanford Research Institute, Menlo Park, Calif.: the effects of spray-droplet size on combustion.

The sales and service of *ARMSTRONG FITTINGS CO.* has been absorbed by *LENNOX INDUSTRIES INC.*

Send for This Useful Reprint Volume

"CORRECT PRACTICE in INDUSTRIAL PIPING"

— Third Edition —

196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

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WE HEAR THAT

Continued

LABELON TAPE CO. has transferred its manufacturing facilities and headquarters to 10 Chapin St., Canandaigua, N.Y. The new building consists of four floors with total space of over 80,000 sq. ft.

The new president of the *GAS APPLIANCE MANUFACTURERS ASSOCIATION* is William G. Hamilton, Jr. John F. Ray is first vice president; Joseph J. Decker, second vice president; Harold Massey, managing director; and Robert C. LeMay, treasurer.

MAXITROL CO. has acquired additional manufacturing facilities in Blissfield, Mich.

Alfred F. Chouinard has been elected president of the *AMERICAN WELDING SOCIETY*.

JOHN J. NESBITT, INC. has broken ground for a new 106,000 sq ft plant in Philadelphia, Pa. Completion is scheduled for October, 1961.

H. A. Eddins has been elected president of the *SOUTHERN GAS ASSOCIATION* for 1961-62. Other officers are Clayton L. Nairne, first vice president; Buell G. Duncan, second vice president; Jack A. Bell, secretary; and B. F. Wombacker, treasurer.

A $2 million expansion program which will include the construction of three new additions to the company's plant at Staunton, Va. will be initiated by *WESTINGHOUSE ELECTRIC CORP.'s* air conditioning division. Work is scheduled to begin in July. A target date of the middle of 1962 has been set for the completion of the project.

A new west coast plant of *H. H. ROBERTSON CO.* will begin production by mid-year in the Port of Stockton Industrial Tract at Stockton, Calif.

VILTER MANUFACTURING CORP. is the new name of the former Vilter Manufacturing Co.

SHELDONS MANUFACTURING CORP. has been formed to produce and market in the U.S. the ventilating and air conditioning equipment designed and engineered by *SHELDONS ENGINEERING, LTD.*, Galt, Ontario, Canada.

ENGINEERS INC., consulting engineers, has acquired the engineering practice of Julius Berger, M.E., and has merged the firm into its operations.

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MEETINGS & CONVENTIONS

JUNE 4-9 — *Seminar on Electrical Precipitation.* The Pennsylvania State University, University Park, Pa. Information: Conference Center, The Pennsylvania State U., University Park, Pa.

JUNE 8-9 — *First Western Conference, National Electrical Manufacturers Association.* The Biltmore Hotel, Los Angeles, Calif. Information: NEMA, 155 E. 44th St., New York 17, N.Y.

JUNE 11-15 — *The 54th Annual Air Pollution Control Association Meeting.* Hotel Commodore, New York, N.Y. Information: Sheldon W. Samuels, director of public information, New York State Air Pollution Control Board, 84 Holland Ave., Albany 8, N.Y.

JUNE 11-15 — *American Society of Mechanical Engineers Summer Annual Meeting.* Statler-Hilton Hotel, Los Angeles, Calif. Information: ASME, 29 W. 39th St., New York 18, N.Y.

JUNE 12-15 — *National District Heating Association, 52nd Annual Meeting.* Wentworth-by-the-Sea, Portsmouth, N.H. Information: John F. Collins, Jr., secretary-treasurer, NDHA, 827 N. Euclid Ave., Pittsburgh 6, Pa.

WEEK OF JUNE 12 — *The Institute of Boiler and Radiator Manufacturers Annual Meeting.* Seaview Country Club, Absecon, N.J. Information: IBR, Room 408, 608 Fifth Ave., New York 20, N.Y.

JUNE 12 — *Air Pollution Instrumentation Symposium,* in conjunction with the *JUNE* 12-16 *Annual Meeting of the Air Pollution Control Association.* Sponsored by ISA and APCA, Hotel Commodore, New York, N.Y. Information: APCA, 4400 Fifth Ave., Pittsburgh 13, Pa.

JUNE 15-16 — *Seminar on the Industrial and Commercial Use of Gas Turbines.* Shamrock Hilton Hotel, Houston, Tex. Information: The Southern Gas Association, 1524 Life Building, Dallas 2, Tex.

JUNE 19-23 — *Air Cleaning Institute.* (see You'll Want to Know, April, page 52, for details) Harvard University School of Public Health, Boston, Mass. Information: Leslie Silverman, SC.D., Harvard School of Public Health, 55 Shattuck St., Boston 15, Mass.

JUNE 25-30 — *American Society for Testing Materials Annual Meeting.* Chalfonte-Haddon Hotel, Atlantic City, N.J. Information: ASTM, 1916 Race St., Philadelphia 3, Pa.

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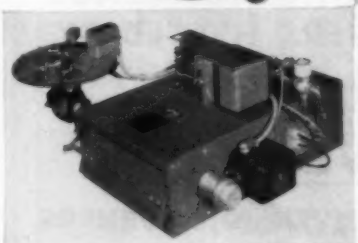

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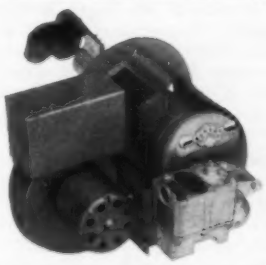

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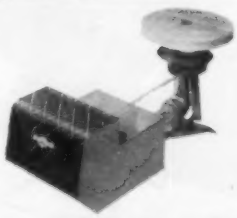

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MEETINGS & CONVENTIONS

Continued

JUNE 26-28 — *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Annual Meeting.* Hilton Hotel, Denver, Colo. Information: ASHRAE, 234 Fifth Ave., New York 1, N.Y.

JULY 18-20 — *Western Plant Maintenance and Engineering Show & Conference.* Pan Pacific Auditorium, Los Angeles, Calif. Information: Western Office, 759 Monadnock Bldg., San Francisco 5, Calif.

JULY 31-*AUGUST* 11 — *Tufts University Summer Institute for Technical Writers and Publishers.* Tufts University, Medford, Mass. Information: Mrs. Florence N. Trefethen, assistant director, 8 N. Hall, Tufts University, Medford 55, Mass.

AUGUST 14-18 — *UA International Apprentice Contest.* Purdue University, Lafayette, Ind. Information: United Association of Journeymen & Apprentices of the Plumbing & Pipefitting Industry of the United States and Canada, United Association Building, 901 Massachusetts Ave., N.W., Washington 1, D.C.

AUGUST 21-31 — *International Exhibition of New Sources of Energy.* To be held concurrently with the *United Nations Conference on New Sources of Energy.* Circo Massimo, Rome. Information: Rassegna Internazionale Elettronica e Nucleare, Via della Scrofa, 14, Rome. (cable address: ROMATOM) Please mark correspondence: International Exhibition of New Sources of Energy.

SEPT. 12-14 — *Southeastern Maintenance and Engineering Show.* War Memorial Coliseum, Greensboro, N.C. Information: John Harden Associates, P.O. Box 3173, Greensboro, N.C.

SEPT. 27-*OCT.* 4 — *The Institute of Heating and Ventilating Engineers, International Conference on Heating, Ventilating and Air Conditioning.* London, England. Information: F. L. Rossetti, secretary, Conference Coordination and Management Committee, 49, Cadogan Sq., London, S.W.1.

OCT. 1-4 — *43rd Annual Meeting, American Gas Association.* Registration, Dallas Municipal Auditorium; various sessions at the Statler Hilton, Sheraton-Dallas, Adolphus, and Baker hotels, Dallas, Tex. Information: AGA, 420 Lexington Ave., New York 17, N.Y.

OCT. 7-10. — *Western Building Industries Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: WBIE, 2216 S. Hill St., Los Angeles 7, Calif.

MEETINGS & CONVENTIONS

Continued

OCT. 16-17 — *International Conference on Air Ionization.* Franklin Institute, Philadelphia, Pa. Information: American Institute of Medical Climatology, 1618 Allengrove St., Philadelphia 24, Pa.

NOV. 12-15 — *Air-Conditioning and Refrigeration Institute Annual Meeting.* The Homestead, Hot Springs, Va. Information: ARI, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 13-16 — *National Warm Air Heating and Air Conditioning Association Annual Convention.* La Salle Hotel, Chicago, Ill. Information: NWAHACA, 640 Engineers Bldg., Cleveland 14, Ohio.

NOV. 13-17 — *American Public Health Association, 89th Annual Meeting, air pollution session.* Cobo Hall, Detroit, Mich. Information: APHA, 1790 Broadway, New York 19, N.Y.

NOV. 26-*DEC.* 1 — *The American Society of Mechanical Engineers Winter Annual Meeting.* Statler Hilton Hotel, New York, N.Y. Information: L. S. Dennegar, director of public relations, ASME, 29 W. 39th St., New York 18, N.Y.

1962

FEB. 12-15 — *Air Conditioning and Refrigeration Industry 12th Exposition.* Pan-Pacific Auditorium, Los Angeles, Calif. Information: George E. Mills, ARI Show Director, ARI, 1346 Connecticut Ave., N.W., Washington 6, D.C.

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*Specifications for Radiationproof Shelters, AEC-tr-*3889 — Translated for the U.S. Atomic Energy Commission from a study by West Germany's Home Construction Ministry. Includes plans for typical shelters. 25 pages. Price, 50 cents. *Preliminary Procedures for the Installation of Ventilating Systems During the Reconditioning of Protective Bunkers, AEC-tr-*3890 — Various ventilation plans for protective bunkers are discussed. Rules governing the dimensions of ventilating systems are outlined with regard to personnel, space, storage space, and space for technical equipment. Filters, heating and cooling devices, and boiler equipment are discussed. Price, 50 cents. — *Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce, Washington* 25, *D.C.*

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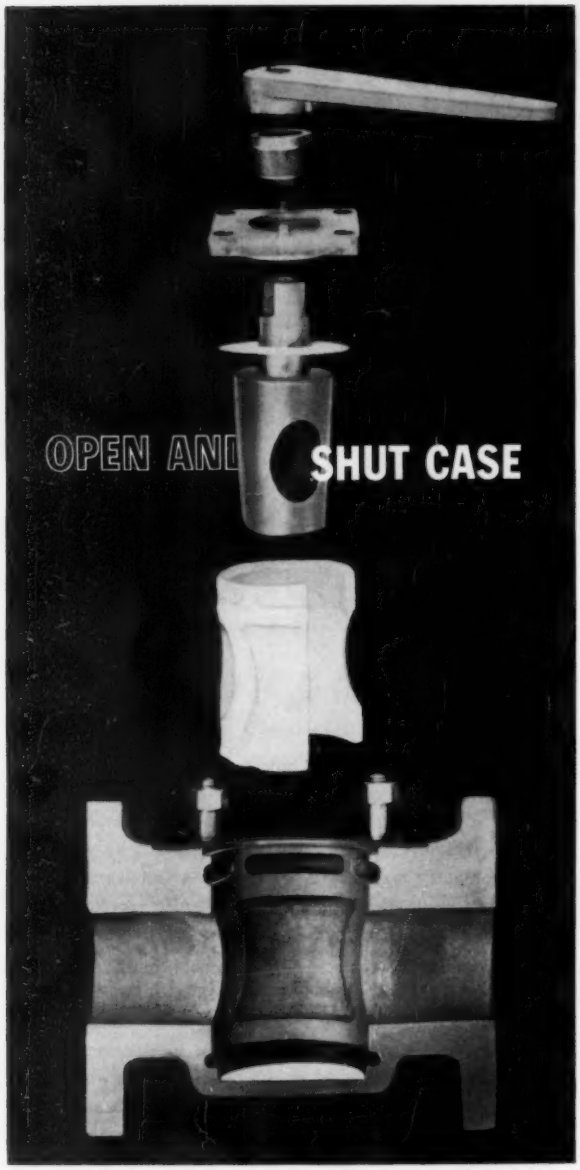

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Air Pollution and Purification, SB-448 — This bibliography lists 124 U.S. Government research reports and translations of foreign literature on air pollution by non-radioactive fumes, industrial gases, smokes, aerosols, and other contaminating agents. Includes articles from Communist China and the Soviet Union. Subject categories include problems and effects of air pollution; studies in levels of pollution; and methods and equipment for air purification. Price, 10 cents. — *Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce, Washington 25, D.C.*

Refrigerant Piping Data — Discusses refrigerant piping design, including references, instructions, and worked-out examples. Illustrated with tables and charts. Price, $3.00. — *Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.*

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Handbook of Mechanical Packings and Gasket Materials — A reference book of 106 pages about the products of this industry, their uses and methods of application. Lists American Standards for non-metallic gaskets for pipe flanges, recommended standards for box dimensions, and technical data on mechanical packings, gaskets, mechanical seals and piston rings. Volume sponsored by the Mechanical Packing Association and published by McGraw-Hill Publishing Co. Price, $2.50. — *Mechanical Packing Association, Inc., 17 John St., New York 38.*

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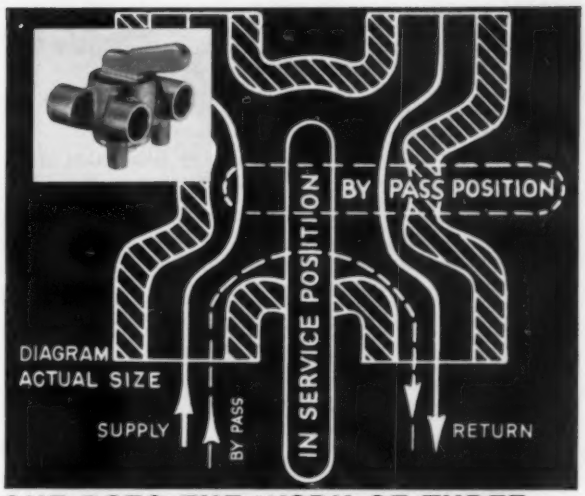

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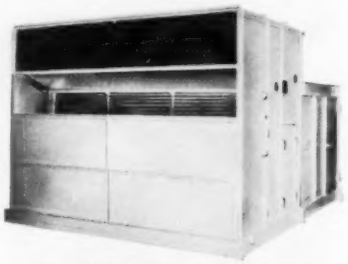
Directory Certified Unitary Air-Conditioners — A new edition of directory carries ratings on more than 2700 units of 53 manufacturers. It is effective through July 31, 1961. — *Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.*

AMCA Who's Who in Certified Performance Ratings in Air Moving Devices — The first edition of an official directory of products licensed to carry the Air Moving and Conditioning Association, Inc. Certified Performance Ratings Seal. Contains essential product identification data on more than 5000 centrifugal, axial, and propeller fans, and power roof ventilators. Information includes manufacturer, unit size, trade names, model numbers, and the latest catalog number and publication date. — *Air Moving & Conditioning Association, Inc., 2159 Guardian Building, Detroit 26, Mich.*



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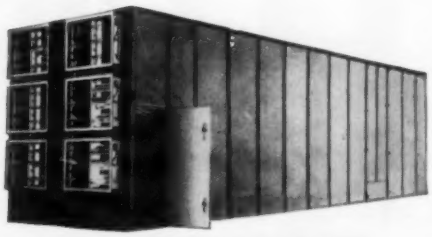

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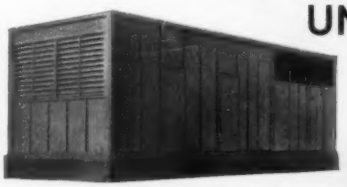

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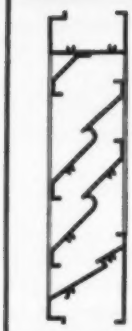

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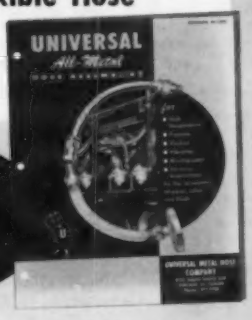

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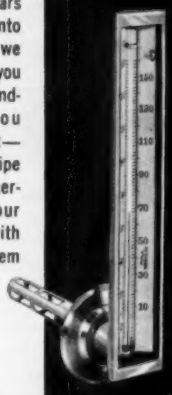

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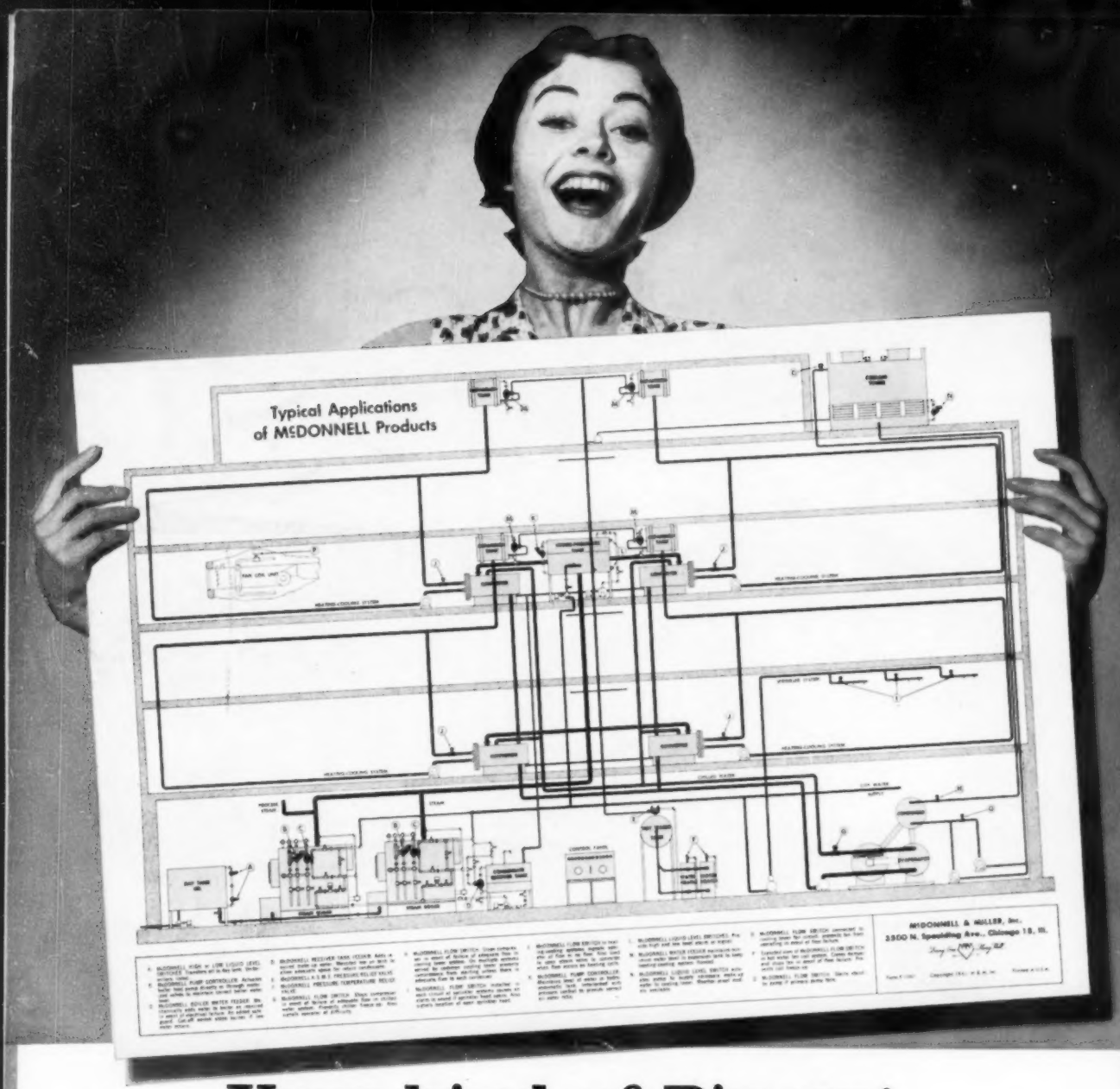

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